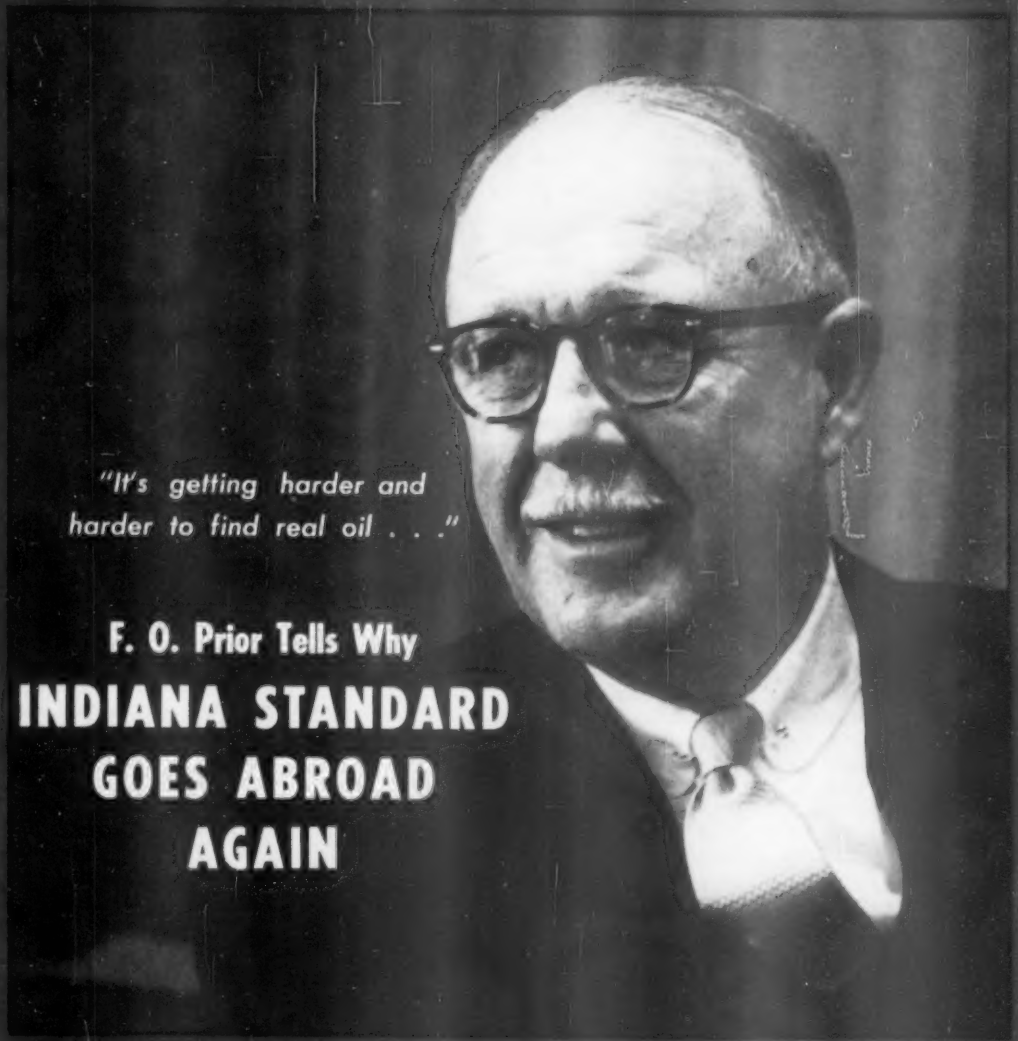
the OIL AND GAS JOURNAL

DECEMBER 17, 1956

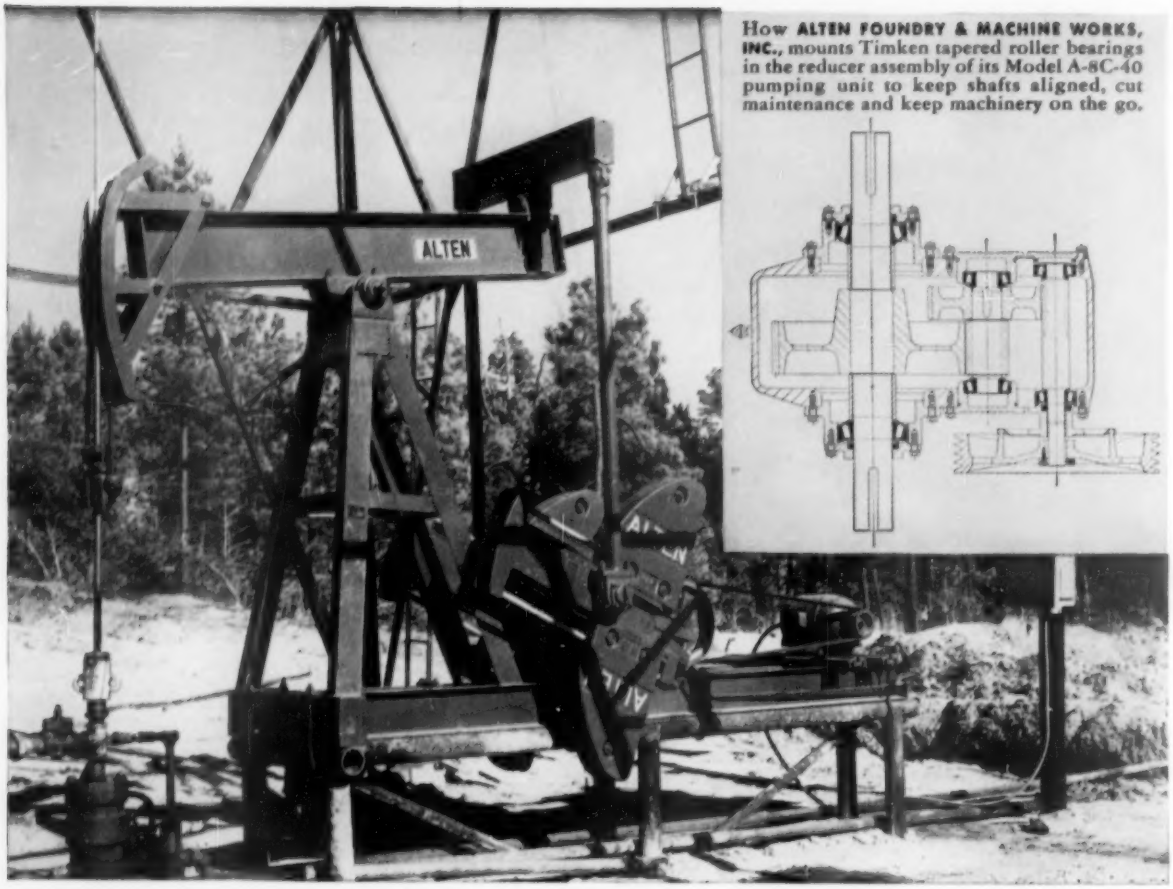


"It's getting harder and harder to find real oil . . ."

F. O. Prior Tells Why

INDIANA STANDARD GOES ABROAD AGAIN

Gas Chromatography—Powerful New Tool Boosts Plant Efficiency p. 126



How **ALTEN FOUNDRY & MACHINE WORKS, INC.,** mounts Timken tapered roller bearings in the reducer assembly of its Model A-8C-40 pumping unit to keep shafts aligned, cut maintenance and keep machinery on the go.

Oil pumping unit is 'all pump—no slump' with shafts on TIMKEN® bearings

ALTEN Foundry & Machine builds pumping units like this model A-8C-40 for the rugged service of the petroleum industry. Because every part is engineered to give uninterrupted field operation, Alten units perform to full-rated capacity day in, day out—pumping oil from deep wells. With the slow speed shaft, intermediate shaft and high speed shaft of the reducer assembly mounted on 6 Timken® bearings, the pump keeps on the go with maximum efficiency. Costly shutdowns are prevented.

Tapered construction lets Timken bearings take radial and thrust loads in all combinations. You get extra load-carrying capacity—with full line contact between rollers and races. By keeping shafts concentric with housings, Timken bearings make closures more effective in keeping lubricant in, dirt, dust out. Timken bearings practically eliminate friction, which reduces wear on related parts, prolongs life. They're geometrically designed to give *true rolling motion,* precision-manufactured to do just that in actual daily service. We even make our own steel, which no other American bearing maker does.

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A Glance Ahead . . . at press time

These Trends will make TOMORROW'S NEWS

The sights are being raised on radiation processing. Energy sources many times as powerful as any proposed a year ago are now planned for laboratories. Use of future power reactors for radiation promises millions of curies now wasted in shielding. Developments will come thick and fast in the next 3 years.

Advance notice of plans for big mergers may be required in the future. A bill may pass Congress next year requiring that the Justice Department and the Federal Trade Commission be notified in advance of plans to merge any companies whose combined assets exceed $10,000,000.

Such a bill passed the House during the last session but got no Senate action. The two agencies have stepped up their propaganda recently. But industry will object that such a law would mean endless policing of even the smallest acquisitions by large corporations. Another objection: Money, rather than the effect on competition, would be the criterion for antitrust enforcement.

Offshore pipeliners may be hit in the pocketbook by new standards for Gulf of Mexico craft adopted by the Coast Guard. They're waiting for an interpretation to see whether lay barges are affected. If so, it could mean the difference between a $50,000 to $100,000 investment for barges now used and $400,000 for a barge to meet new standards of seaworthiness. This would be a heavy outlay for equipment which, because of the weather, can be used only 6 months of the year.

Another round of synthetic liquid fuels development may be in the making.

A ready-to-go synthetics industry would be an ace in the hole in the event the United States had to develop new sources of supply for another war, which the current Egyptian situation demonstrates it likely would. Western congressmen are expected to take the lead in a drive to put the government back into the research field with a mandate to work fast to perfect an economically feasible process for making synthetic oil.

Plans for a line from Kirkuk field to tidewater may be firmed up soon by Iraq Petroleum Co. The company gave serious consideration to a line from Kirkuk to the Persian Gulf, despite the long tanker haul to Europe.

But this plan has cooled. A line from Kirkuk to a Turkish Mediterranean port now looks like the best bet. Until the line is built, or present lines are repaired, all but about 30,000 bbl. of Kirkuk's daily output of more than 500,000 bbl. will remain shut in.

A decision on the Four Corners to Los Angeles crude line proposed by Shell and Standard of California is expected this week. Details of the plan were being hammered out last week in a conference of eight companies in New York. The Texas Co. is understood to be interested in an extension from Four Corners to Jal near the Texas-New Mexico border. Initial plans were for a 14-in., 50,000-bbl. line whose capacity could be doubled later (The Oil and Gas Journal, October 22, p. 74).

Oil-field pipe is still scarce. Some buyers claim it is going at a 40 per cent premium price and is hard to find. One of the most common complaints is that major companies are hoarding it, keeping several months' supply on hand. Even with steel mills working at capacity there's the constant threat of curtailed output. International tension plus perennial labor unrest combine to make future supplies uncertain.

The OIL AND GAS JOURNAL

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Refining-Processing

SPECIAL SECTION: Gas Chromatography **126-140**

A special section compiled by Journal editors on this new, fast, accurate analytical tool for refining, natural-gasoline, and petrochemical plants. The method is applicable for plant as well as laboratory use, and a number of process-stream applications either have been or soon will be made. This seven-article section covers all phases of the operation.

Estimating Fuel-Oil Market With Climatic Odds **122**

By Loren W. Crow

It's impossible to determine a growth pattern and to estimate how much fuel oil your customers will demand unless you have made a long-term study of the weather by the "climatic odds" method.

The Foreman's Page **143**

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Pipelining

What Causes Underbead Cracks in Welds? **108**

By A. M. Hill and F. W. Zilm

Service Pipe Line Co. has developed a new maintenance-welding procedure for use on pipelines where the pipe surface temperature is below 50° F. The new procedure outlines methods and materials to be used.

Estimating Fuel-Oil Market With Climatic Odds **122**

Pipeline Patrol: Zinc Anodes for Cathodic Protection **155**

By C. W. Ambler, Jr.

Zinc was the first expendable metal to be used as anode material for cathodic protection, and it should still be considered when a long-life design is desired.

Drilling-Production

Equipment for Air Drilling **113**

By V. A. LaFave

What kind of equipment should you have for air drilling? What types of compressors are available? Does present equipment meet the needs? Here are answers to these important questions.

Fit Your Pumping Motor to The Job **117**

By F. W. Beach

Unless field engineers and foremen understand characteristics of electric motors, they may install more horsepower than needed on the pumping unit. This article gives the equations and instruments needed to make good size selections.

Well Tester Scores High in Accuracy **120**

By G. F. Duncan and J. D. Leonard

Continental Oil Co. has designed a unique well-testing device to gage water and oil production from individual wells. First installation was on Continental's Settles waterflood project.

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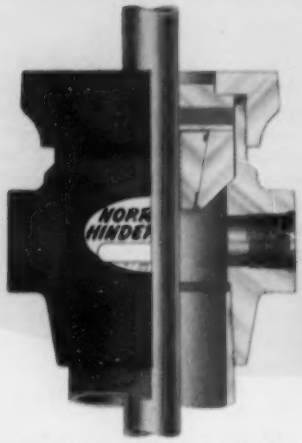

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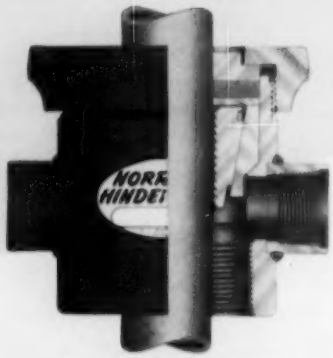

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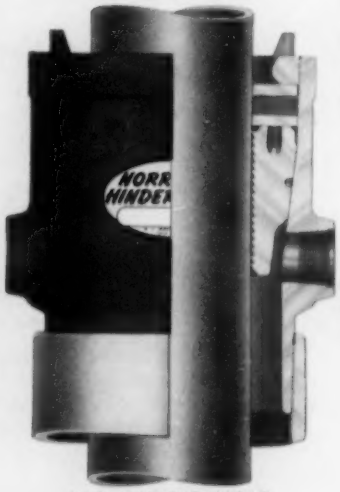

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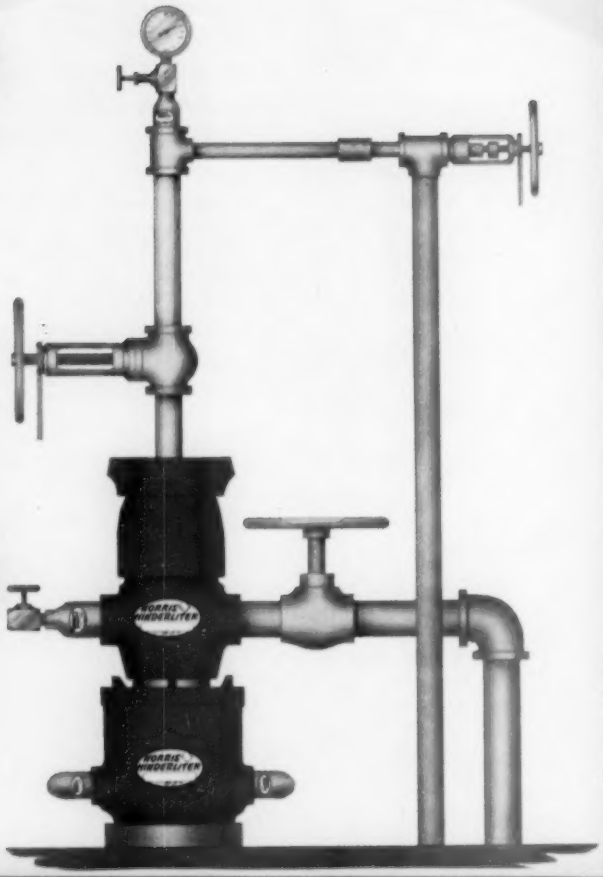

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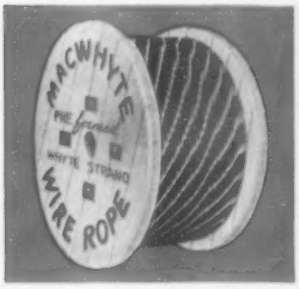

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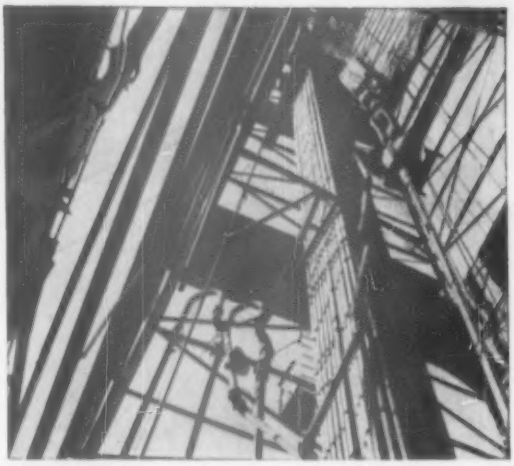

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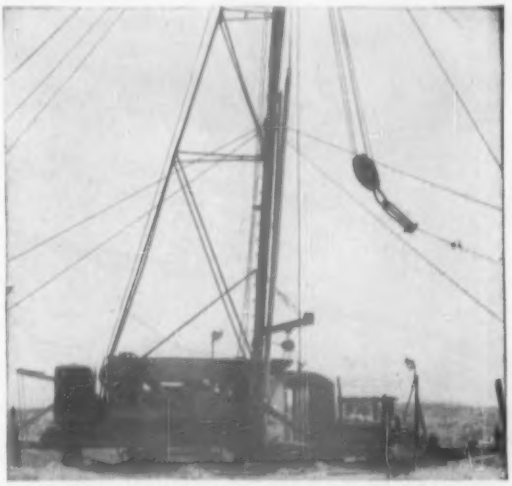

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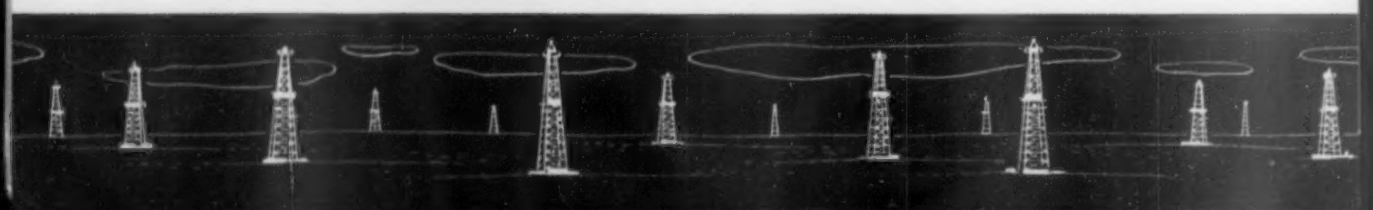

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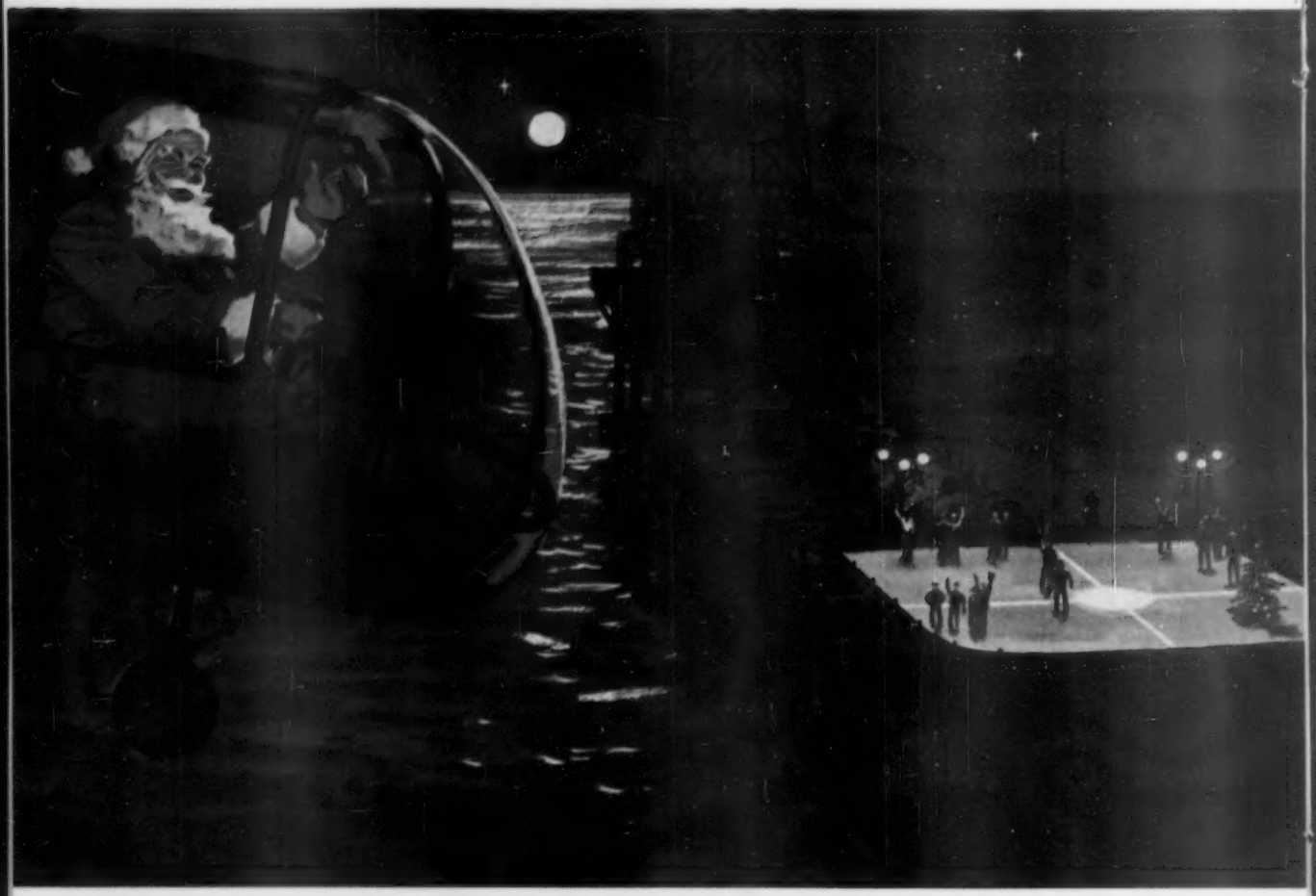

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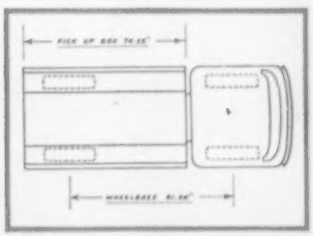

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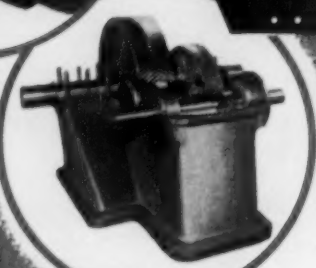

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We'd like to show you how a great many leading companies have improved their communications and pocketed sizable savings with P-A-X—the "inside" business telephone system.

P-A-X keeps your present switchboard and phones free for outside calls. Lets you make inside calls in a flash—OVER YOUR OWN PRIVATE TELEPHONE SYSTEM. And P-A-X sharply cuts telephone operating costs.

Top firms in all industries save time and money with P-A-X—in fact, they tell us they'd be in a jam without it. See for yourself. Let us send you interesting case history studies that give facts and figures.

Write: Automatic Electric Sales Corporation, 1033 W. Van Buren Street, Chicago 7, Ill. *In Canada:* Automatic Electric Sales (Canada) Ltd., 185 Bartley Drive, Toronto. *Offices in principal cities.*

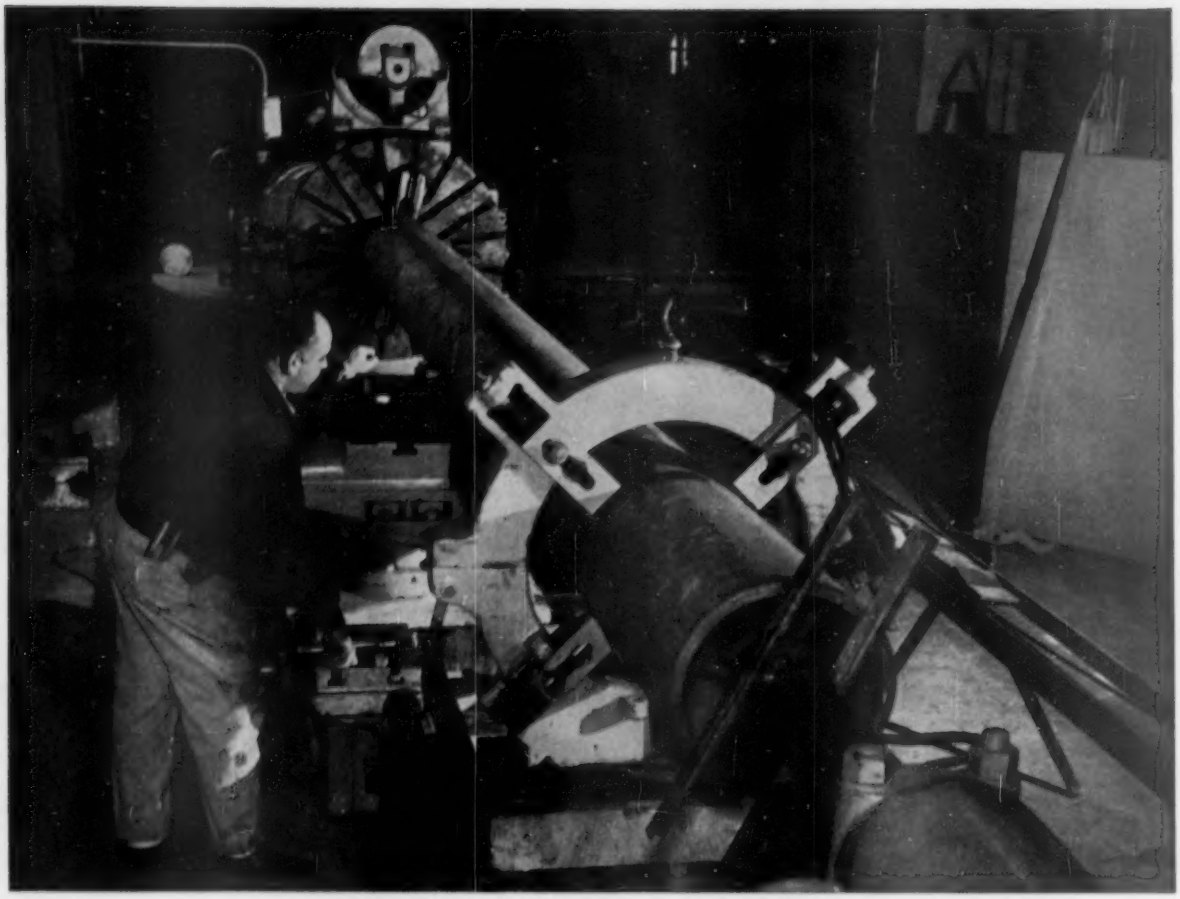
P-A-X *business telephone systems*

AUTOMATIC ELECTRIC

Originators of the dial telephone · Pioneers in automatic control

GENERAL TELEPHONE SYSTEM

MERRY CHRISTMAS
Wilson
Wilson



ALCO FACILITIES ASSURE VALUE IN PREFABRICATED PIPE

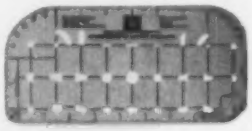
Machines and Methods at ALCO's Plant Handle All Sizes of Seamless Pipe, Any Alloy or Grade; Modern Welding Techniques Used for All Materials.

ALCO brings to prefabricated pipe production a modern plant, completely equipped with machine tools to handle any size, alloy or technique. Facilities include large lathes *(above)*, other heavy machine tools, induction heat-treating for joint preheat and stress relief after welding.

Advanced quality control methods are another important factor in ALCO prefabricated pipe. Use of X-ray machines and cobalt 60 pills to test welds is an example of up-to-date inspection and test procedures.

Experience and production know-how are also factors in ALCO prefabricated pipe. Pipe manufacture draws on welding techniques which have placed ALCO in a leading position in the welding field. ALCO's experience in heat-exchange equipment, both refinery and power plant, aids in piping manufacture.

Your inquiries on ALCO piping will receive prompt handling at any ALCO Sales Office, or, if you wish, write P. O. Box 1065, Schenectady 1, N. Y.



Information on how to obtain the ALCO piping drawing layout template, a definite aid in making piping layouts, is available from ALCO, P. O. Box 1065, Schenectady 1, N. Y.

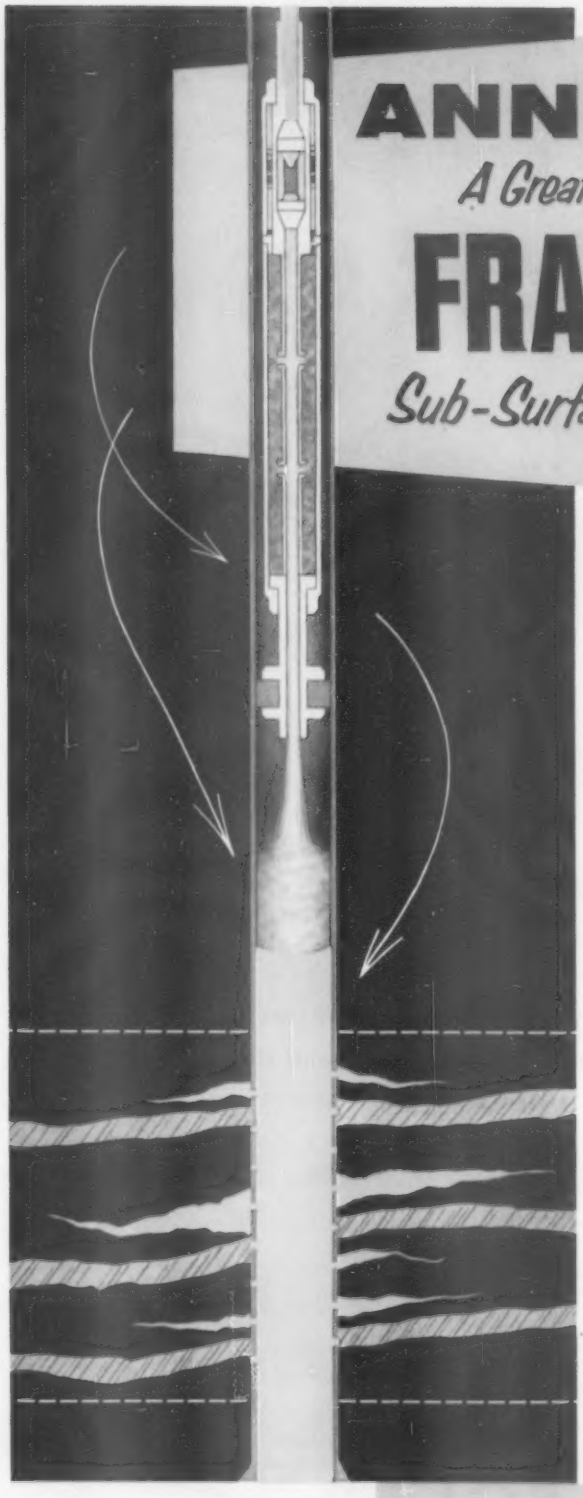
ALCO

ALCO PRODUCTS, INC.

NEW YORK

Sales Offices in Principal Cities

Locomotives · Diesel Engines · Nuclear Reactors · Heat Exchangers · Springs · Steel Pipe · Forgings · Weldments · Oil-Field Equipment



ANNOUNCING

A Great New Fracturing Tool!

FRAC-ASSIST

Sub-Surface Packaged Power Unit

gives a 5000 hydraulic horsepower "down-hole" boost to surface-pumped fracturing

FRAC-ASSIST IS A NEW TECHNIQUE

This sub-surface packaged power unit is located above the zone to be fractured. When triggered, the Frac-Assist tool acts as a huge instantaneous, single-stroke pump. It generates 5000 hydraulic horsepower to displace fluid and boost existing surface-pumped fracturing force.

Frac-Assist does not compete or interfere with normal fracturing procedures. It literally *assists* this flow by greatly accelerating and emphasizing the fracturing power *right at the zone to be* fractured. Little energy is lost to friction. You get high injection rates at high pressure... with minimum fluid loss.

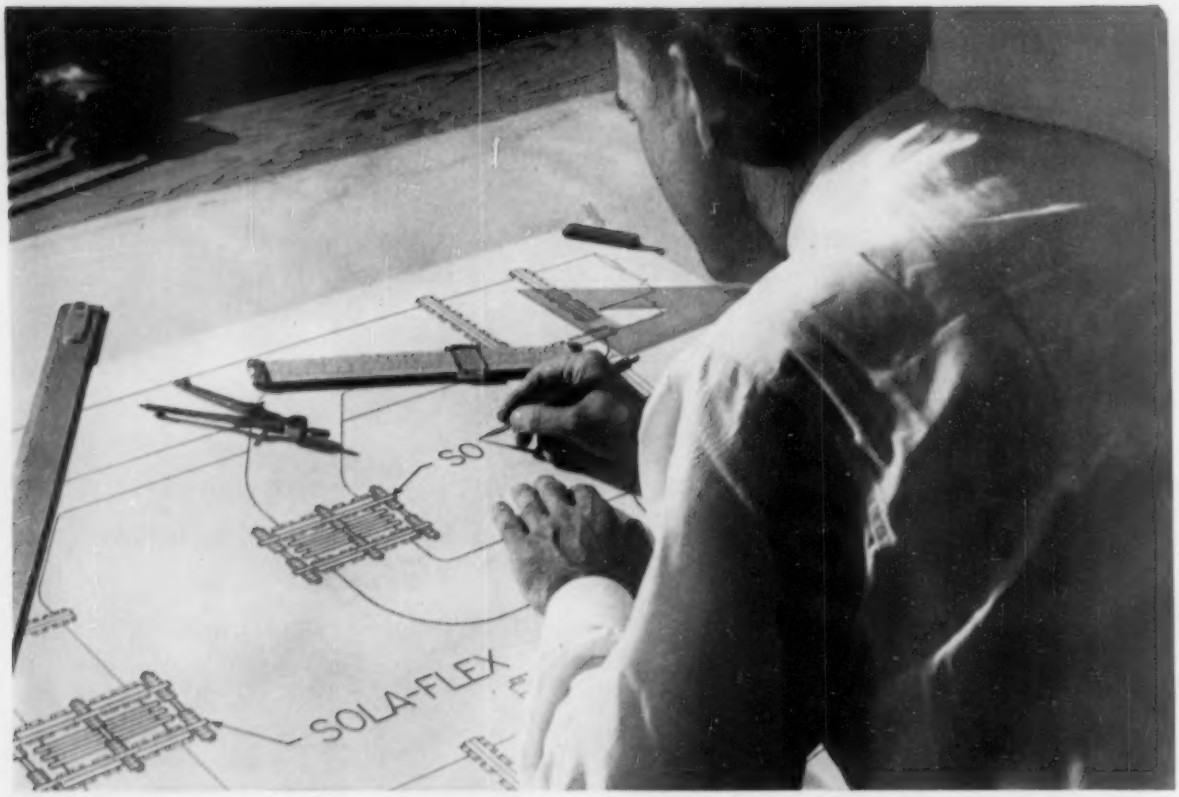
The Frac-Assist Tool—located above the zone to be fractured—is triggered from the surface by introducing a tubing plug into the fracturing fluid stream. When this plug enters the Frac-Assist Tool, it detonates blank cartridges which initiate a controlled burning of a gas-generating fuel. The high-power gas force builds up inside the Frac-Assist chamber until it exceeds pressure in the tubing—then it pushes through the blowout plugs and exerts a tremendous, nearly instantaneous downward surge behind the fracturing fluid already in the tubing. This produces a super fracturing force, to open multiple and highly-productive fractures—fractures which are maintained and extended by the normal, uninterrupted pumping flow which immediately follows the Frac-Assist striking force.

Engineered by BJ Service—offered only through BJ Service—Chemical Process

Chemical Process
General Offices and Laboratory
Breckenridge, Texas
Stations Throughout the Mid-Continent Area

CHEMICAL PROCESS
BJ
Service

BJ SERVICE, INC.
General Offices and Laboratory
Long Beach, California
Stations Throughout California, Rocky Mountain and Permian Basin Areas



In piping "specs" specify Sola-Flex

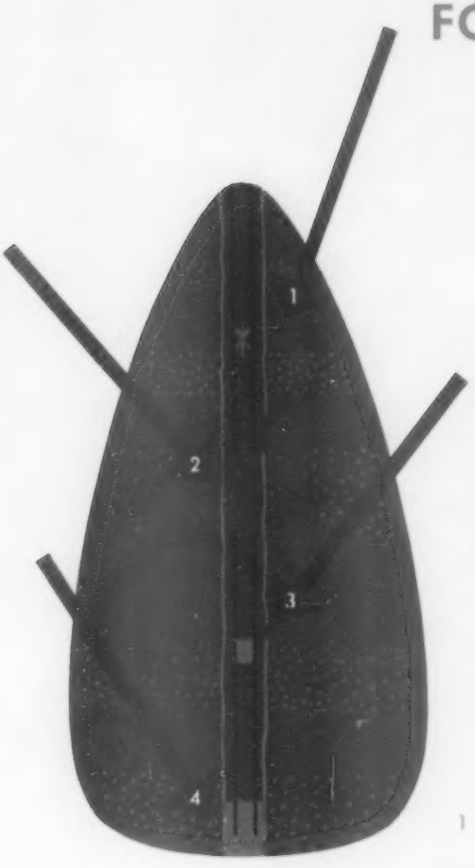
YOU BENEFIT many ways when you call for Sola-Flex expansion joints in a high or low pressure piping installation. Durable and economical, Sola-Flex joints are custom-engineered, based on advanced designs perfected by Solar. They are built of a variety of metals in a vast array of sizes, shapes and configurations. And Sola-Flex joints have been proven in service—in all types of installations throughout the petroleum, utility, chemical, petrochemical, and other industries.

Send for the latest Sola-Flex catalog—many pages of valuable data. Write Dept. C-109, Solar Aircraft Company, San Diego 12, California.

SOLAR
AIRCRAFT COMPANY
SAN DIEGO
DES MOINES

Designers, Developers and Manufacturers • Gas Turbines • Aircraft and Missile Components • Bellows • Controls • Coatings • Metal Alloy Products

ODD-JOB "HANDY MAN" FOR REMEDIAL WORK



HALLIBURTON'S DUMP BAILER SERVICE

If any single service could be called the odd-job "handy man" of the oil fields, Halliburton's Dump Bailer Service surely qualifies. Any combination of the specially designed, highly efficient Dump Bailer Unit, the "DB" Bridging Basket or the Limit Plug and Halliburton's Cal-Seal gypsum cement makes it possible to do a variety of jobs easily, quickly and economically.

YOU BENEFIT ON JOBS LIKE THESE:

1. *Pipe Repairs*—A "DB" Bridging Basket may be run in to desired bridge point on bottom of Dump Bailer—or a Limit Plug can be set where bridge is desired.
2. *Securaloy Removal*—Placing a chemical solution in the well by means of the Dump Bailer. Removes securaloy sections of pipe within eight hours.
3. *Nitro-Glycerine Shot Tamps*—Placing quick-setting Cal-Seal on top of shots, for a tamp, by means of the Dump Bailer.
4. *Plug Back Jobs*—The Dump Bailer is ideal to plug back in the bottom of the hole where excess hole is not desired.

COMPLETE DATA SENT ON REQUEST

Get this valuable information for your Halliburton Service File

With Halliburton's Dump Bailer Service goes sixteen years of experience with methods and techniques that accomplish better results while they save you time and money. Ask your Halliburton field representative for complete information. Call your local or district office of the Halliburton Oil Well Cementing Company, Duncan, Oklahoma.

HALLIBURTON
CEMENTING SERVICES

251 SERVICE CENTERS—JUST MINUTES AWAY FROM ANY RIG

A Highlight of the Christmas Season is the Pleasure that comes when Friends and Business Associates pause to extend to each other

Greetings and Best Wishes

THE Bovaird SUPPLY COMPANY

GENERAL OFFICES
TULSA, OKLAHOMA

85 YEARS OF PROGRESS WITH THE OIL INDUSTRY

TUBE-TURN

In small piping too you get big savings by welding

Five years ago, the generally accepted practice among engineers and contractors was to weld non-critical pipe larger than 2-inches and thread the smaller sizes. Today, that dividing line has gone down; much piping as small as ½-inch is now being welded. In small piping as in large, the big reason for welding is *to save money . . .* in installation cost, in material cost, in maintenance cost. See next page for typical results. For the small pipe jobs, too, you get the *most for your money* when you specify and buy TUBE-TURN* Welding Fittings and Flanges. Your nearby Tube Turns' Distributor can give you speedy service in sizes from ½-inch to 42 inches!

The Leading Manufacturer of Welding Fittings and Flanges

TUBE TURNS LOUISVILLE 1, KENTUCKY

A Division of National Cylinder Gas Company

DISTRICT OFFICES: New York • Philadelphia • Pittsburgh • Cleveland • Detroit • Chicago • Kansas City • Denver
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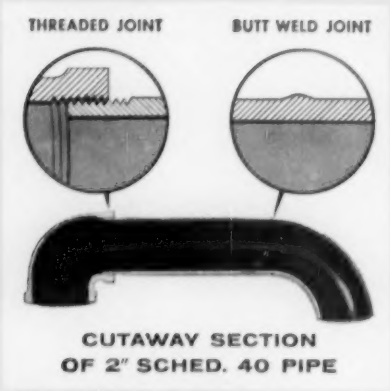
*"TUBE-TURN" and "tt" Reg. U.S. Pat. Off.

WHY IT PAYS...

SMALL DIAMETER PIPING... *why it pays to specify welded construction with* TUBE-TURN *Fittings*

NEVER LEAKS. Welded joints are permanently as strong and leakproof as the pipe itself. Photo shows welded lube oil lines for one of four diesel engines, replacing threaded lines which leaked. If welded in first place, would have saved $4000 replacement cost. Pipe is 2½" with TUBE-TURN Fittings.



CUTAWAY SECTION
OF 2" SCHED. 40 PIPE

SAVES MATERIAL. Threading cuts half of pipe wall away as shown. The welded joint is as strong as the pipe. An installation of Schedule 40 pipe, welded, is stronger than Schedule 80 threaded. Hence, for equal strength welded piping can cut material costs 30-50%.

TAKES LESS TIME to weld than to thread pipe above 2" and about equal time for smaller sizes, according to recent tests on hundreds of joints made by many different pipe fitters. Welded joints in 1½" piping such as the school heating line shown, averaged 7 minutes compared to 8 minutes for threading and tightening fitting.

IS COMPACT, NEAT. This installation of 1½" and 2" boiler blow-off piping shows ability to nest welded lines close together for better layout and streamlined appearance. Also, insulation, where needed, is easier to apply.

TOOLS ARE SIMPLE. Small, inexpensive welding outfits can cut, weld, heat to bend, solder or braze. They are easy to haul to job and simple to use. All pipe for this factory radiant heating system was fabricated on the site.

FITTINGS READILY AVAILABLE. In small sizes, too, your Tube Turns Distributor is stocked to give you prompt, efficient service. Call him on *all* your needs in welding fittings and flanges . . . from ½" to 42".

MORE INFORMATION—This bulletin gives helpful information on "The Economics of Welding Small, Noncritical Pipe". Mail the coupon for your free copy.

TUBE TURNS, Dept. J-6
224 East Broadway, Louisville 1, Kentucky

Please send free copy of "Economics of Welding Small, Noncritical Pipe".

Company Name _____

Company Address _____

City _____ *Zone* _____ *State* _____

Your Name _____

Position _____

Available from your nearby TUBE TURNS' distributor

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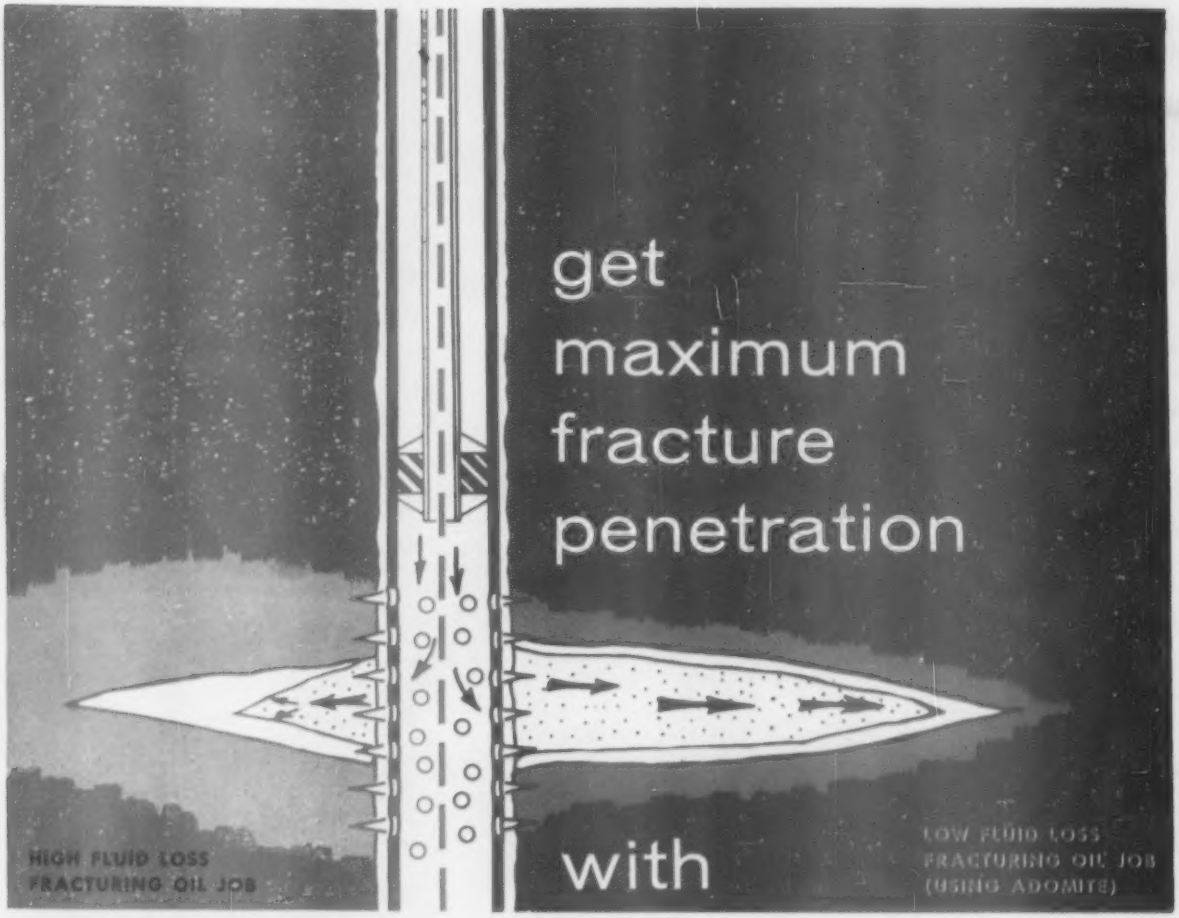
A DIVISION OF NATIONAL CYLINDER GAS COMPANY
LOUISVILLE 1, KENTUCKY



Adomite®

CUTS FLUID LOSS TO LESS THAN 10 CC.'S

(API Code 29 Fluid Loss Test)

Here are some very sound reasons why producers everywhere are fracturing with Adomite, the fluid-loss control agent proven profitable in 10,000 field treatments.

INSTRUCT YOUR SERVICE COMPANY TO USE ADOMITE

Adomite—developed and manufactured by Continental Oil Company

Adomite ® trade-mark, Continental Oil Company
© 1956, Continental Oil Company

Seals the fracture face . . . minimizes fluid loss . . . no damage to formation.

Longer fractures . . . deeper penetration of sands.

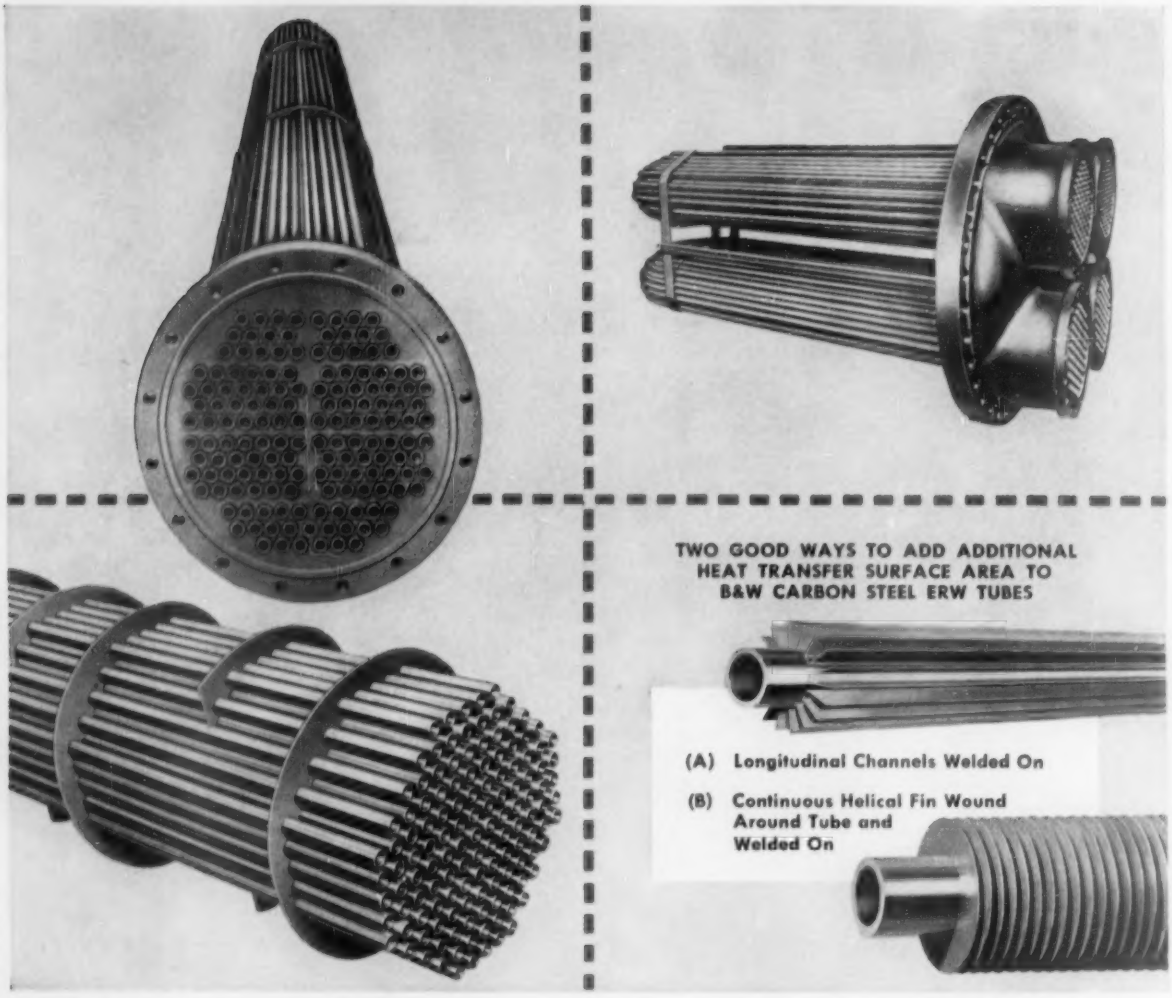
Fewer sandouts . . . reduces fluid loss in rock matrix, prevents buildup of sand concentrations in the fracture.

Saves you money . . . utilizes your own lease crudes . . . saves transportation costs.

Decreases friction loss . . . low viscosity of Adomite-created fracturing fluids permits use of less pumping equipment than with viscous refinery residuals.

Reduces hazard of emulsions . . . emulsion-breaking characteristics are important consideration to many producers.

Adomite, and **only Adomite** is all you need to control fluid loss of kerosene, crudes, gelled crudes or refinery residuals.


TWO GOOD WAYS TO ADD ADDITIONAL
HEAT TRANSFER SURFACE AREA TO
B&W CARBON STEEL ERW TUBES
(A) Longitudinal Channels Welded On
(B) Continuous Helical Fin Wound
Around Tube and
Welded On

TUBING REQUIREMENTS FOR HEAT TRANSFER EQUIPMENT

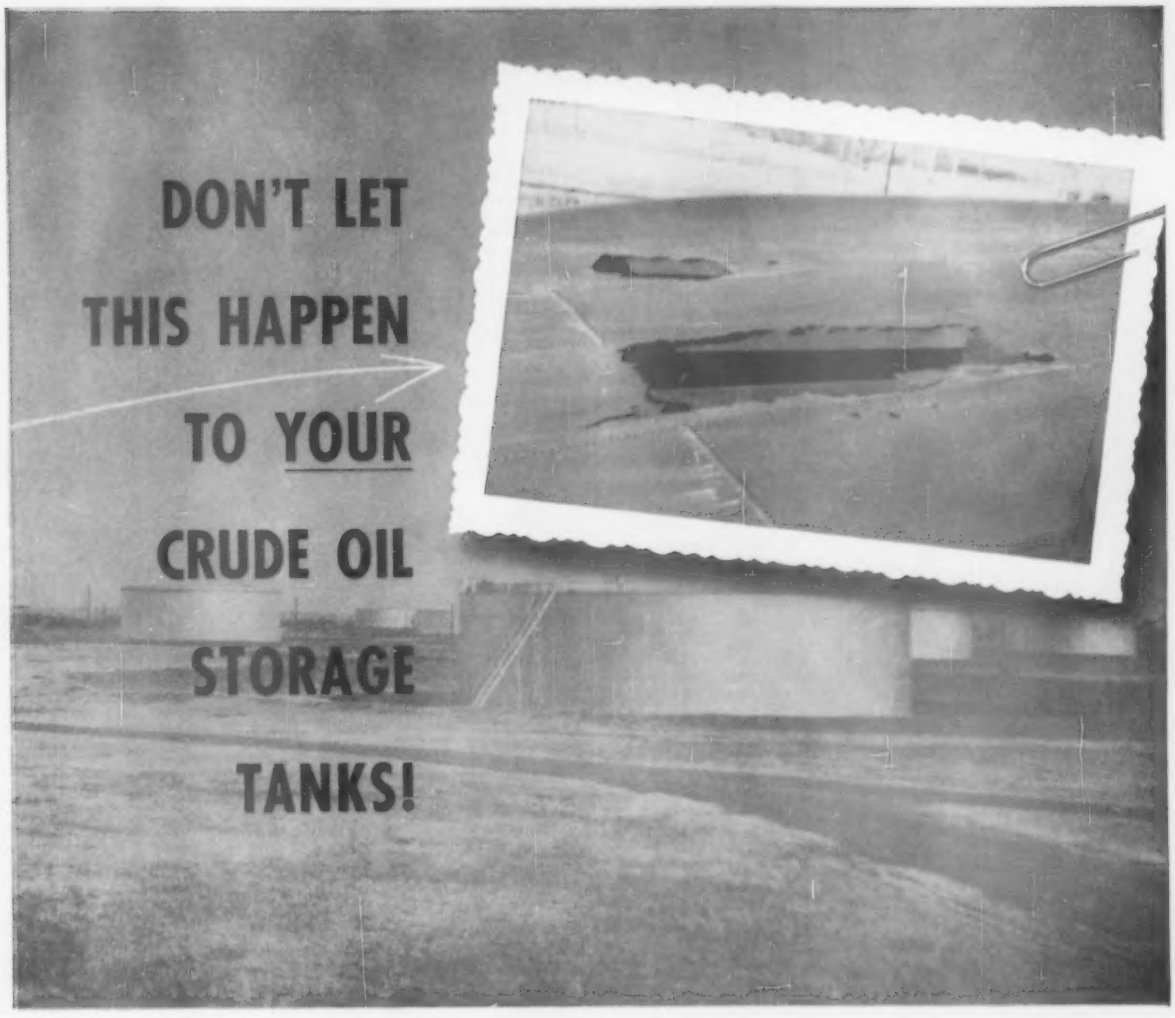
The economy and usefulness of pressure tubing in heat exchanger and condenser applications depend on the tubing's heat transfer ability and the ease with which it can be bent, coiled, swaged, and rolled into tube sheets.

Because of its uniform wall thickness, the heat transfer ability of B&W Electric-Resistance-Welded Carbon Steel Tubing is the optimum for such a ferrous material. It is an economical material to use, not only because of its reasonable first cost, but also because of its low fabrication cost, since ease of bending, coiling, swaging, and rolling into tube sheets is provided through quality-controlled methods used in its manufacture.

B&W Electric-Resistance-Welded Carbon Steel Heat Exchanger and Condenser Tubing is widely used in the process industries, including petroleum refining and chemical processing, and in refrigeration and steam generating equipment. If carbon steel tubing can do the job required, you will find B&W ERW Tubing provides maximum, trouble-free service life. For additional information, call on Mr. Tubes, your nearby B&W Tube Representative — *or write for Bulletin 412.* The Babcock & Wilcox Company, Tubular Products Division, Beaver Falls, Pa.

TA 6099-GP

Seamless and welded tubular products, seamless welding fittings and forged steel flanges—in carbon, alloy, and stainless steels



Protect them with New Pitt Chem

TARSET®

RIGHT *now*—as you read this—corrosion may be destroying thousands of dollars worth of your petroleum handling and storage equipment. It happens every day, as witness the photograph of the crude oil storage tank top, above.

Now—for the first time—you *can* control these costly corrosion losses with a practical and relatively economical protective coating—new Pitt Chem "Tarset." This revolutionary new approach to crude oil corrosion combines the best qualities of two of industry's most effective and proven protective materials—*coal tar* and *epoxy resin.*

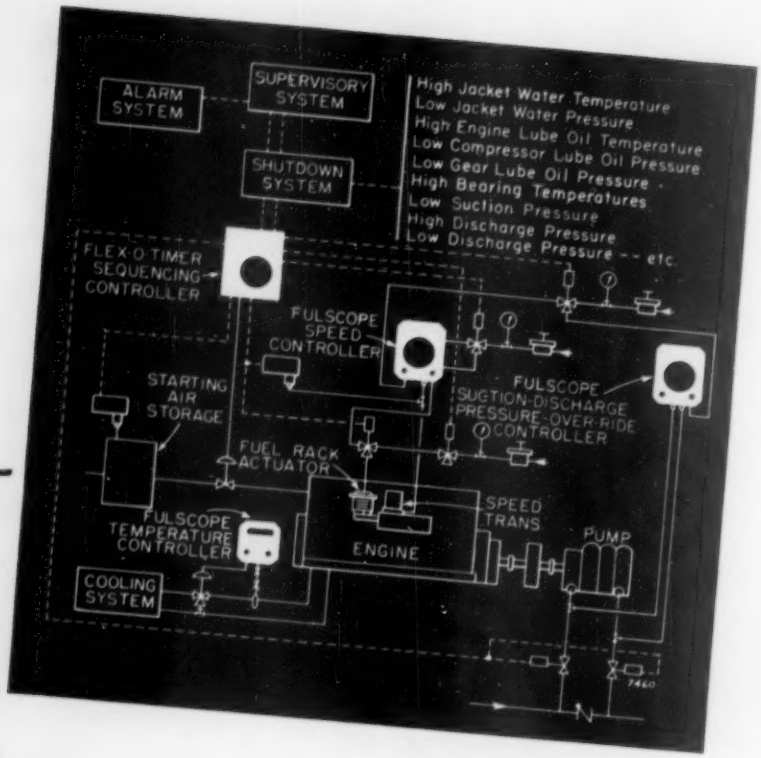
Tarset is the kind of a rugged, heavy duty coating you want. It will not shatter at —30°F or soften at 400°F. It is easy to apply by brush, spray or roller and adheres so well that it is almost impossible to remove from metal.

What's *your* crude oil corrosion problem? Our Pitt Chem engineers are ready to tackle it right now . . . and, if possible, come up with some dollar-saving answers for you. *Write or call us today!*

WSW 6086

COAL CHEMICALS • PROTECTIVE COATINGS • PLASTICIZERS • ACTIVATED CARBON • COKE • CEMENT • PIG IRON

A dream materializes—



UNATTENDED PUMPING STATIONS NOW PRACTICAL WITH *Taylor* CONTROLS!

FULLY Automatic start-up and shut-down control of diesel or gas powered pumping stations has always been considered impractical in that the problem was either too complex or instrumentation was just not available. The schematic drawing above shows how a booster station can be provided with automatic start-up and shut-down, using standard Taylor instruments. This system can be applied to reciprocal or turbine gas engines or diesel engines—with remote or local initiation. Of course, this basic system can be modified to suit your specific needs, and flow or specific gravity signals can be incorporated.

The resultant benefits, in terms of reduced operating costs, are so great as to require no elaboration here. Why not call in your Taylor Field Engineer to analyze your present system and give you a quotation for "going automatic." Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada.

Typical System (above) for Automatic Start-up and Shut-down of Engines

START-UP:

1. Main line valves open.
2. Starting air on and fuel rack opened to starting position after valves are open. (Failure to start simply restarts sequence.)
3. Starting air of engine placed on proportional speed control to come up to idling speed.
4. Engine on proportional-plus-reset speed control for warm-up period.
5. Suction discharge pressure override system adjusts speed control point.

SHUT-DOWN:

1. Engine speed reduced to idling.
2. Fuel rack closed.
3. Main valves closed.

EMERGENCY SHUT-DOWN:

Engine fuel rack and main valves closed.

Taylor Instruments MEAN ACCURACY FIRST

Get More Hole For Your Wire Rope Dollar with J&L SpringKore Rotary Drilling Lines

SpringKore's tightly coiled, high quality steel spring center was developed by J&L to give rotary drillers a wire rope with unusually high resistance to crushing action *plus* extreme flexibility.

Check these features of J&L SpringKore Rotary Drilling Lines and see why you get longer service life on your rotary rigs at lower drilling line costs.

LONG-TERM FLEXIBILITY
SpringKore's highly flexible center and wide distribution of internal pressures maintains original rope flexibility under long periods of heavy-duty service.

RESISTS CRUSHING ACTION
Coiled steel spring center has great resistance to crushing . . . snaps rope back to its original shape and diameter.

COMPLETE LUBRICATION
SpringKore's hollow center acts as a lubricant reservoir . . . reduces corrosion and friction wear by assuring lubrication of innermost parts of rope.

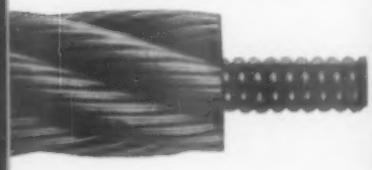
MORE SUPPORTING CONTACT POINTS
The coiled shape of the spring center gives the strands of the rope more supporting points . . . reduces friction by spreading pressure evenly over many contact points.

UNIFORM DIAMETER
The firm internal support provided by the spring center maintains uniform rope diameter . . . reduces wear caused by outer strands rubbing against each other.

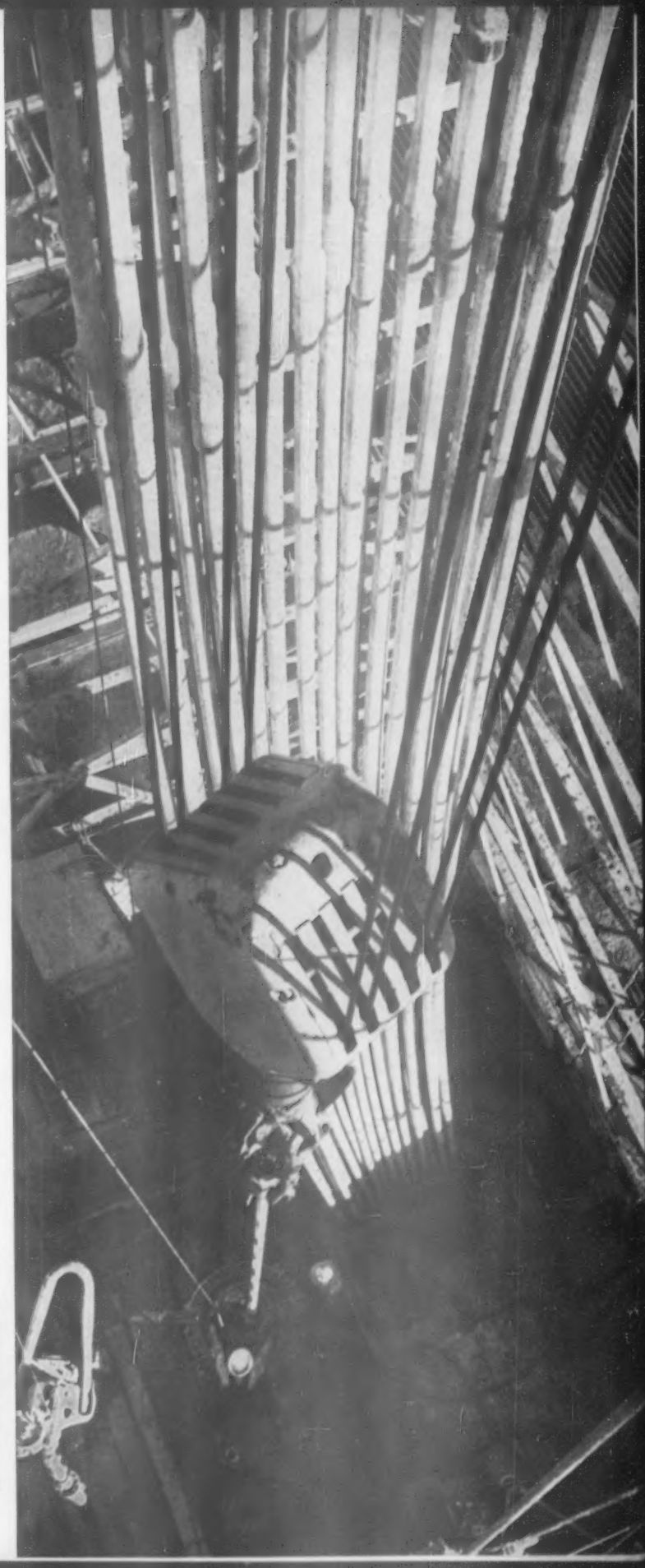
LESS INSIDE STRAND WEAR
The spring center flexes under crushing instead of scoring strands . . . reduces wear on inside wires.

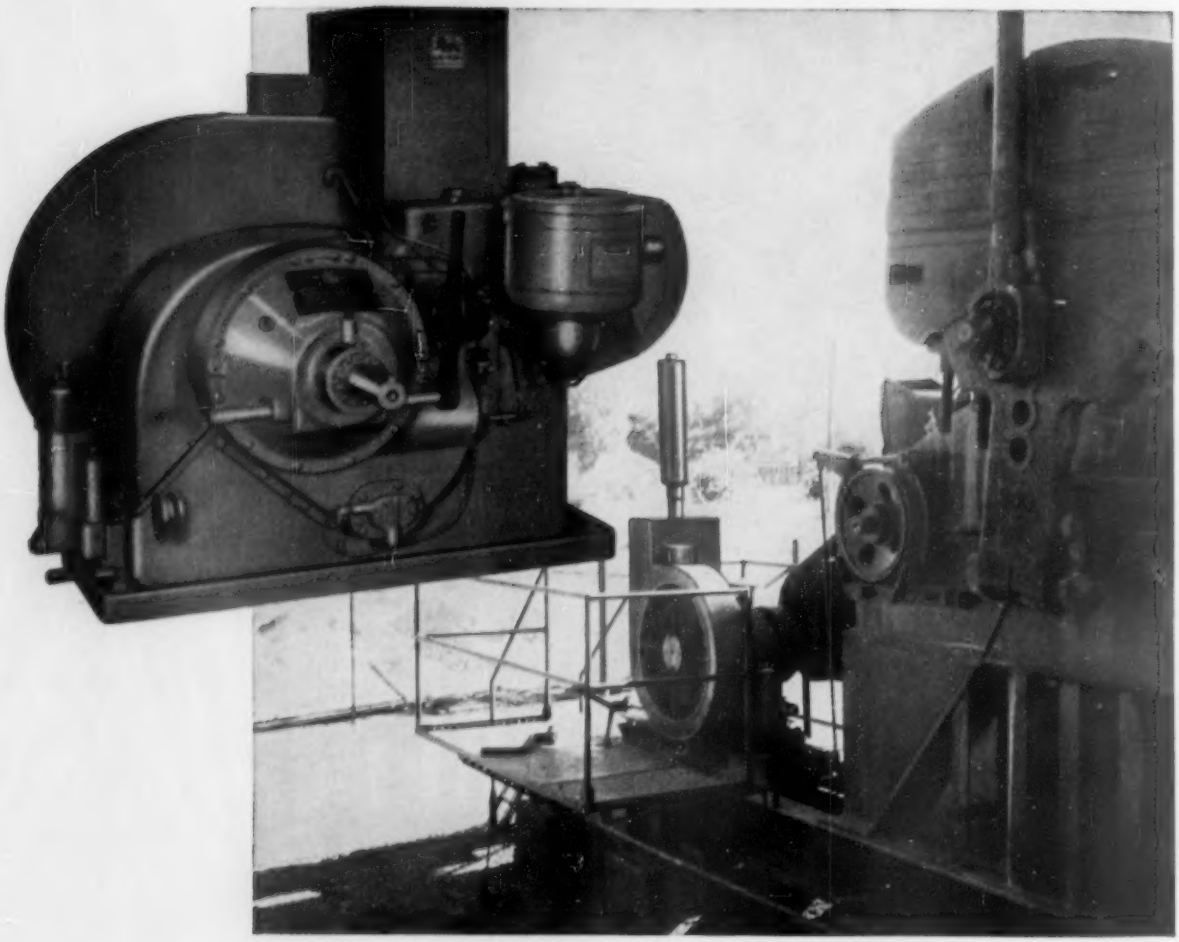
Put these SpringKore advantages to work on your rotary drilling rigs. Specify J&L SpringKore Rotary Drilling Lines. Available in standard sizes and construction.

Jones & Laughlin
STEEL CORPORATION · PITTSBURGH



J&L STEEL





Total Operating Cost Only 1.2 Mills per Hp Hour

. . . that's why it pays to do your pumping with Le Roi A288's

ACCORDING to the major oil company using this 26.3 max. hp A288, this operating cost is lower than that of any of their other engines.

And here are some of the reasons why the A288 cuts the cost of pumping — why it can run two weeks at a time without inspection.

Patented, "vaporizing-condensing" cooling system seldom needs make-up water. Uniform high temperatures reduce corrosion and sludging.

No superfluous acccessories like grease fittings, conventional-type fan and belts to need attention.

Generous crankcase permits long intervals between oil changes — and no shutdown is required to inspect oil level or add oil.

And performance-wise, you can't beat the A288, or the smaller 14.9 max. hp A114 sister engine, either. One typical installation has more than 47,000 hours on it. Stamina like this is one reason why the A288 is the only pumping engine recommended by a major user for continuous service *unattended for up to two weeks' time.*

Standardize on A288's and watch your pumping costs drop. You can get them from your supply house, or your Le Roi distributor. Or write us for our latest bulletin.

LE ROI *Division of Westinghouse Air Brake Co.*

Milwaukee 1, Wisconsin. Oilfield Headquarters, Tulsa, Oklahoma

P-130

Working storage tank at Cromwell, Okla., is pumping or receiving 80 per cent of the time, has a throughput of 2,500,000 bbl. per year. It handles select crude and mixed crude-casinghead gasoline. It is owned by Mid-Continent Pipe Line Co., subsidiary of D-X Sunray Oil Co.

Still cutting evaporation loss after two years

with Microballoon spheres*

Two years ago, D-X Sunray Oil Co. equipped this 35,000-bbl. cone-roofed tank with "Microballoon" spheres made from BAKELITE Brand Phenolic Resins. Since that time, this vapor-stopping blanket has reduced evaporation loss an estimated 70 to 80 per cent according to D-X Sunray.

Installing the spheres took eight men about three hours. Within 24 hours, the "Microballoon" spheres had formed a blanket spread over the entire oil surface. Today, this foam seal is still effective after some 5,000,000 bbl. of oil have been pumped through the tank.

These results indicate the economy and effectiveness of this method of evaporation control. To learn more about it, write today to Department VL-128.

*Registered trade-mark of The Standard Oil Co. (Ohio)

for evaporation control . . .

BAKELITE BRAND RESINS

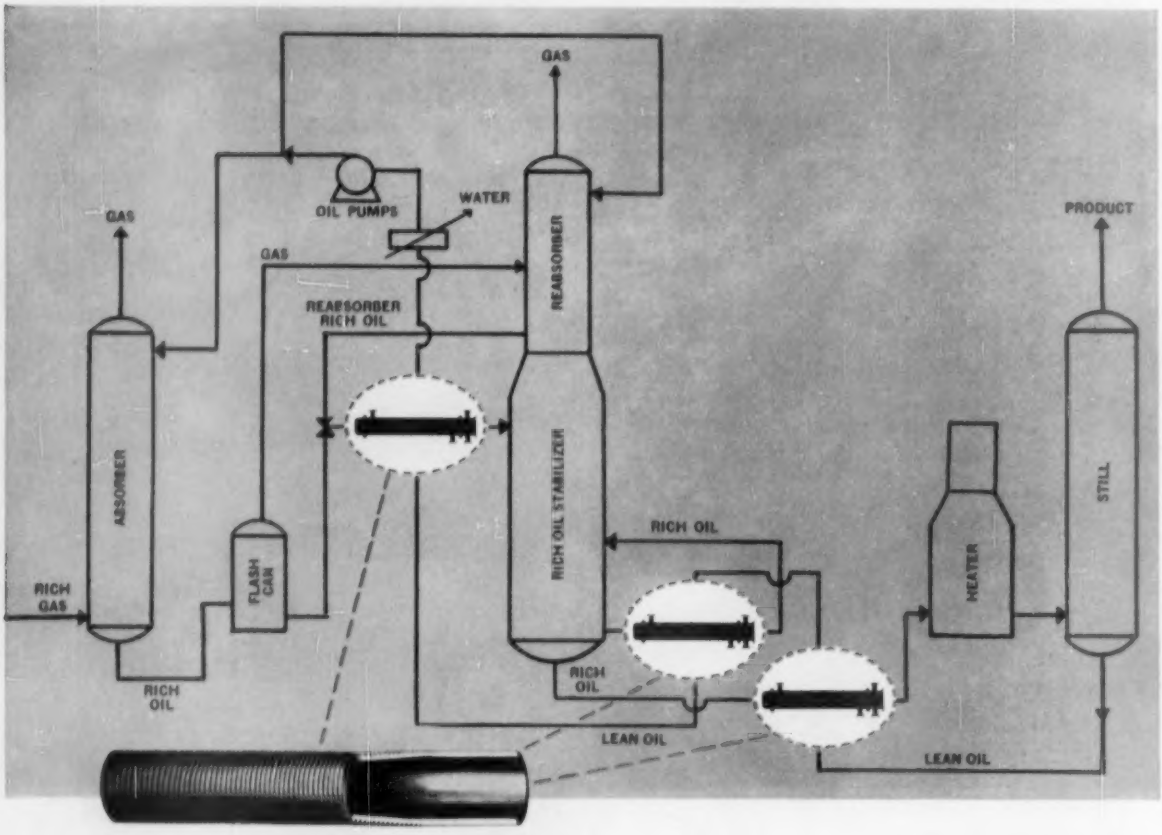
BAKELITE COMPANY, *A Division of Union Carbide and Carbon Corporation* UCC 30 East 42nd Street, New York 17, N. Y.

In Canada: Bakelite Company, Division of Union Carbide Canada Limited, Belleville, Ontario

The term BAKELITE and the Trefoil Symbol are registered trade-marks of UCC.

Real opportunities in heat exchange—
Number 12 of a series.

How One Southwest Processor Obtained Increased Efficiency in Lean Oil—Rich Oil Exchangers



HEAT EXCHANGERS TUBED *with Wolverine Trufin* Type S/T*

The light hydrocarbon recovery system charted above shows where Wolverine Trufin Type S/T condenser tubing was used effectively in lean oil—rich oil heat exchangers.

Trufin was specified by this processor when he found that it would help him transfer more BTU's per foot of tube—give him more capacity, using smaller units, than he could obtain with exchangers containing prime surface condenser tube.

Because Trufin is a *finned condenser tube*, there is more surface area available for heat transfer. Wolverine Trufin has *integral construction*—the fins are squeezed right from the tube wall—it has the stamina to stand up under rugged operating conditions.

Yes, you can cash in on these benefits, too. *Opportunity* is spelled out in a Wolverine technical book entitled just that. Write for your copy, today.

WOLVERINE TUBE, 1449 Central Avenue, Detroit 9, Michigan.

*REGISTERED U.S. PATENT OFFICE

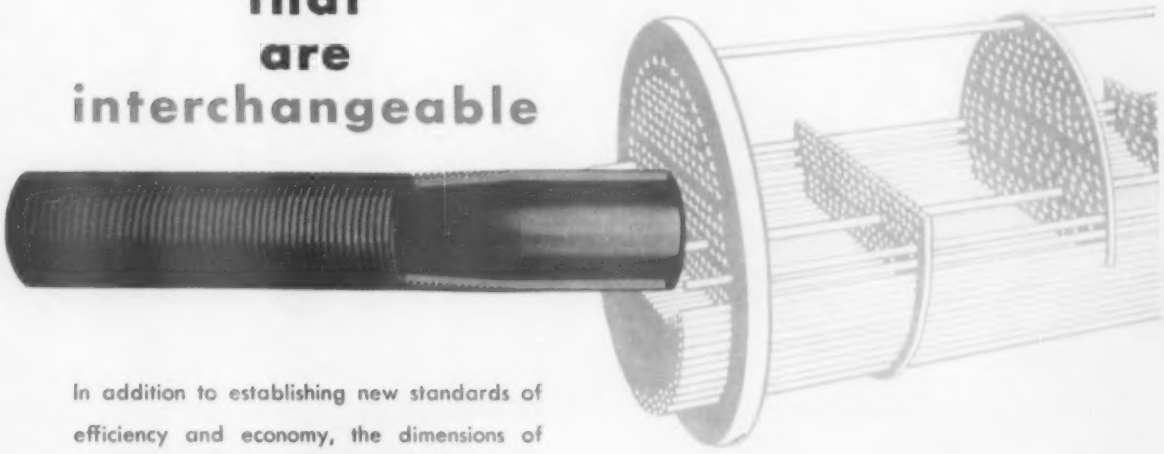
CALUMET & HECLA, INC.
CALUMET DIVISION
WOLVERINE TUBE DIVISION
FOREST INDUSTRIES DIVISION
GOODMAN LUMBER COMPANY
CALUMET & HECLA OF CANADA LIMITED
CANADA VULCANIZER AND EQUIPMENT COMPANY LIMITED

WOLVERINE TUBE
Division of Calumet & Hecla, Inc.
Manufacturers of Quality Controlled Tubing and Extruded Aluminum Shapes

PLANTS IN DETROIT, MICHIGAN, AND DECATUR, ALABAMA • SALES OFFICES IN PRINCIPAL CITIES
EXPORT DEPT., 13 E. 40TH ST., NEW YORK 16, N. Y.

CONDENSER TUBES

that are interchangeable



In addition to establishing new standards of efficiency and economy, the dimensions of Wolverine Trufin* Type S/T are such that it is completely interchangeable with prime surface tubing.

You can boost the capacity of existing units by *directly substituting* Trufin Type S/T for plain condenser tube. Type S/T is specifically designed for shell and tube heat exchangers. Being completely INTERCHANGEABLE—it can be rolled into tube sheets as easily as plain tube—using the same fabrication methods and the same tools.

Standard retubing procedures are used with Trufin Type S/T because the outside diameter of the finned section is no greater than the outside diameter of the plain end which is rolled into the tube sheet. As an additional design advantage, the wall at the plain end section is approximately two gauges heavier than the specified tube gauge. This affords a better bond at the tube sheet and provides additional protection against inlet erosion.

Because of Trufin Type S/T, you can now reap the benefits of extended surface condenser tube in existing equipment. Remember—Type S/T is INTERCHANGEABLE—specify it next time you retube. Write for the Trufin Opportunity Book. It will guide you to new heat transfer economy.

PRIME SURFACE TUBE

Remember, too, that Wolverine is a leading manufacturer of prime surface condenser tube. Wolverine customers can specify exactly the tube they need from a wide range of sizes and alloys in copper and aluminum.

*REG. U.S. PAT. OFF.

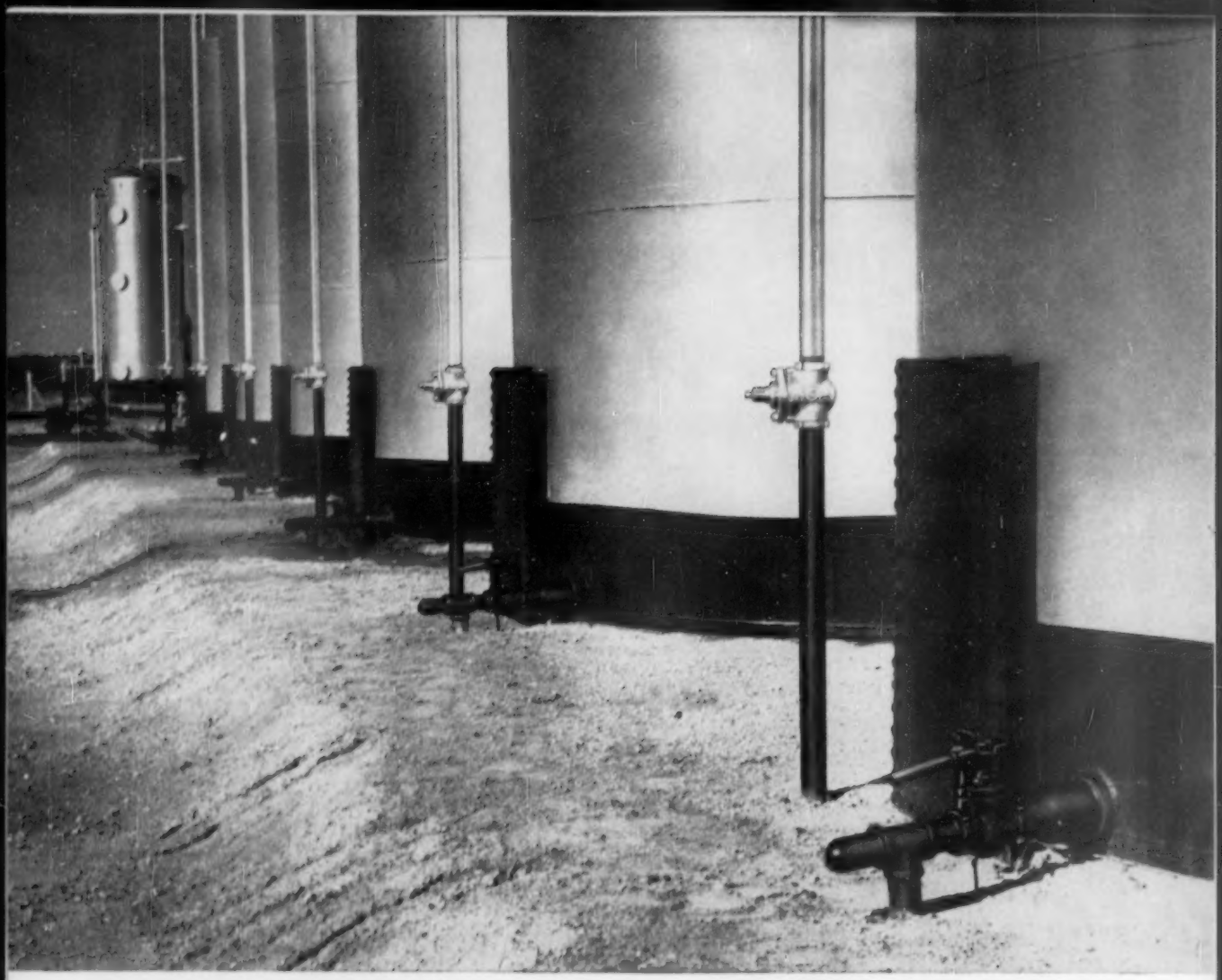
CALUMET & HECLA, INC.
CALUMET DIVISION
WOLVERINE TUBE DIVISION
FOREST INDUSTRIES DIVISION
GOODMAN LUMBER COMPANY
CALUMET & HECLA OF CANADA LIMITED
CANADA VULCANIZER AND EQUIPMENT COMPANY LIMITED

WOLVERINE TUBE
Division of Calumet & Hecla, Inc.
Manufacturers of Quality Commercial Tubing and Extruded Aluminum Shapes

4803

Wolverine Trufin is available in Canada through the Unifin Tube Company, London, Ontario

PLANTS IN DETROIT, MICHIGAN, AND DECATUR, ALABAMA. SALES OFFICES IN PRINCIPAL CITIES.



DWARFS IN SIZE . . . GIANTS IN IMPORTANCE

Valves are usually small in comparison to the size of the units they control. But a leaking 2″ valve can cost you just as much in product loss as a hole in a 60 foot storage tank.

In Rockwell-Nordstrom valves, pressurized lubricant sealing guards your profits with a leakproof dependability that can't be matched by ordinary valves. You'll get trouble-free flow control, too, because lubricant jacks the plug for *instant*, quarter-turn operation even when the valve has been open or closed for months.

Rockwell-Nordstrom valves are available in a full range of sizes and pressure ratings. They cost no more to buy, often less, than ordinary valves—and they'll always save you money. Write for more details: Rockwell Manufacturing Company, Pittsburgh 8, Pa. Canadian Valve Licensee: Peacock Brothers Limited.

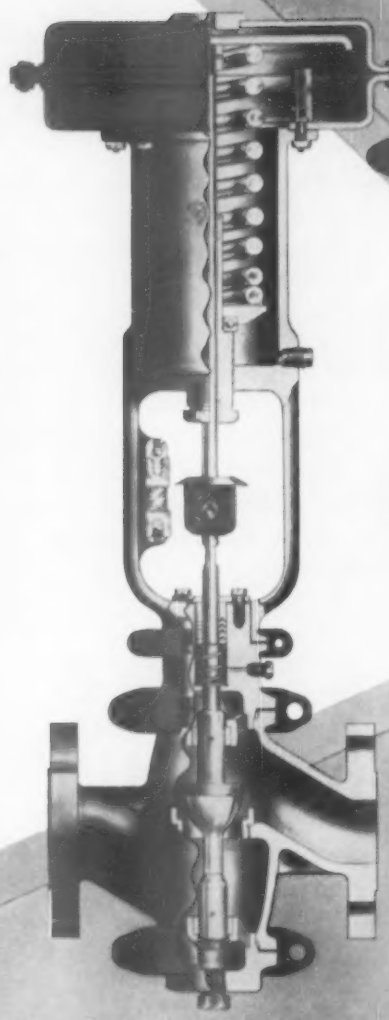
ROCKWELL-Nordstrom **VALVES**

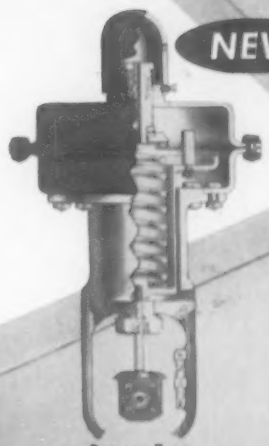
LUBRICANT SEALED FOR POSITIVE SHUT-OFF

40th YEAR *of lubricated plug valve leadership*

New BS&B Super 70 series TOPWORKS

...Give FAST, ACCURATE Response!





Reverse Type Topworks

NEW Buna-N moulded diaphragm, reinforced with nylon, gives uniform cross sectional thrust over full valve travel.

NEW Cadmium plated pressed steel diaphragm cases give maximum strength and corrosion resistance with minimum weight. Special chromate treatment provides superior bonding agent for paint and added corrosion protection.

NEW Bolted clamp ring device integrates body and topworks assemblies into a single unit, and permits yoke to be oriented to any convenient position for observation and action.

Four sizes of Super 70 Series Topworks are available in both direct and reverse acting types. Both are interchangeable on single port, double port, or split body styles. A single spring, precision calibrated to plus or minus 2% of rating, provides accurate travel response to changes in diaphragm loading pressure. (Reverse type topworks uses recessed spring). Ductile iron yoke provides the rigidity of cast iron and the safety of steel. All units use split and bolted stem connector and adjustable travel scale plate.

This advertisement highlights only features of the Super 70 Series Topworks. For information on the new valve bodies of the Super 70 Series line, ask for Catalog 70-11.

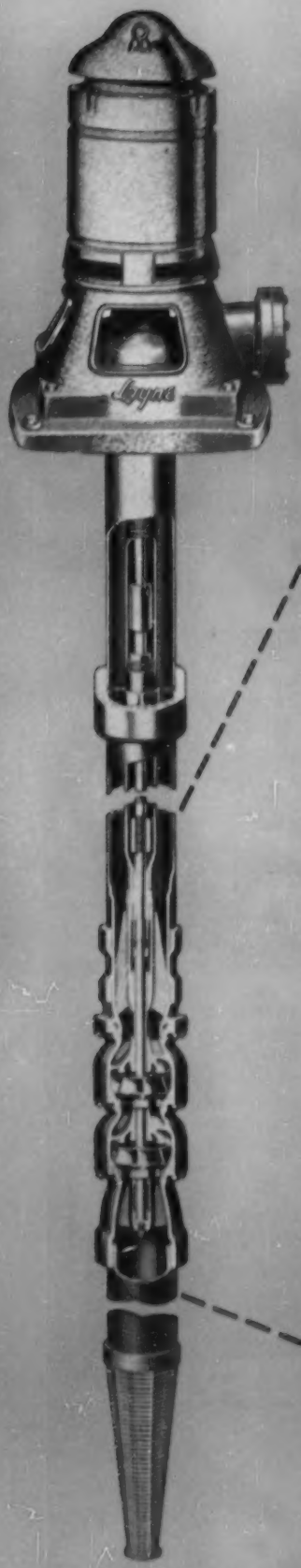
EFFICIENCY OVER 40 YEARS BS&B RELIABILITY — ANOTHER EXAMPLE OF PRODUCT LEADERSHIP

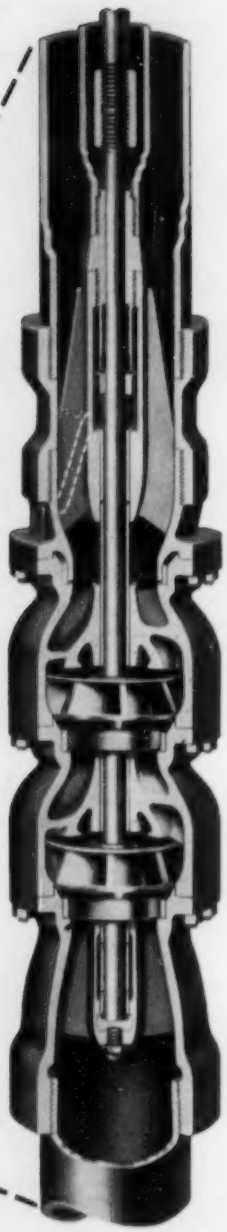
BLACK, SIVALLS & BRYSON, INC.

Controls Division, Dept. 4-A12

7500 East 12th Street — Kansas City 26, Missouri

Precision Built from Performance-Proven Design





The basic design of Layne vertical turbine pumps has been tried and proved under all kinds of operating conditions, both good and bad, the world over.

The finished pumps are produced by skilled craftsmen, in one manufacturing plant, using highest standards—Layne standards.

Industries, municipalities and agriculturalists can rely on the fact that it is prudent and safe to rely on Layne.

For example, consider Layne pump bowls—the very heart of a pump.—

- ★ Designed by top flight hydraulic engineers, the best available anywhere.
- ★ Heavy, rugged construction to give long service under gruelling conditions.
- ★ Clean, smooth flowing water passages in intermediates and hand-finished impellers for high operating efficiencies throughout long operating life.
- ★ Careful and continuous production control from design board to shipping crate—nothing left to chance.
- ★ Produced with the prime objective of pumping water at minimum operating cost—BETTER BUILT FOR BETTER SERVICE.

LAYNE
& BOWLER, INC.
MEMPHIS
General Offices and Factory

LAYNE ASSOCIATE COMPANIES THROUGHOUT THE WORLD

Water Wells • Water Treatment
Vertical Turbine Pumps

CONDENSER TUBE CLINIC

Edited by Arthur W. Tracy,
Metallurgical Engineer,
The American Brass Company,
Waterbury, Connecticut

25 Years' Experience has proved the Value of Arsenic as an Inhibitor

Research at The American Brass Company nearly a quarter of a century ago showed that about 0.04% arsenic would inhibit dezincification of brass, and this amount of the element has been added to Admiralty metal and aluminum brass since then.

Inland power stations find that ANACONDA Arsenical Admiralty-439 serves well under normal water conditions, its arsenic content effectively inhibiting dezincification.

Tidewater power stations must contend with much more corrosive waters, and ANACONDA Ambraloy-927, the arsenical aluminum brass, is preferred because it is not only resistant to dezincification but also to impingement or erosion pitting by either clean or polluted sea waters flowing at relatively high velocities.

Oil refineries have virtually made ANACONDA Arsenical Admiralty-439 standard for refinery condensers and heat exchangers handling crudes, rerun stocks, cracked products, lubricating oils, and by-products. It is resistant to dezincification and can handle corrosive cooling waters at relatively high temperatures. Another important property is its ability to withstand attack by sulfur compounds resulting from the refining of sour crudes. ANACONDA Ambraloy-927, because of its resistance to dezincification and to pitting corrosion by sea water at relatively high velocities, is sometimes preferred in oil refineries on tidewater.

Marine users generally find ANACONDA Arsenical Admiralty-439 satisfactory for inland-water vessels and also for seagoing vessels where service conditions are moderate; but ANACONDA Ambraloy-927 is preferred for most seagoing vessels. Both alloys are resistant to dezincification under all corrosive conditions found in these services.

Your own needs may call for these corrosion-resistant Anaconda alloys or they may call for other tube alloys we make. Our Technical Department will be glad to help you select the one best alloy for the conditions you face.

Technical Service—Get full information on our technical services and products by writing The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ont. 5676

APPROXIMATE MECHANICAL AND PHYSICAL PROPERTIES
(Light Annealed Tubes)

	Arsenical Admiralty-439	Ambraloy-927
Tensile Strength, psi.	52,000	60,000
Yield Strength, 0.5% Elongation, psi.	22,000	27,000
Elongation in 2", %	60	55
Rockwell Hardness "B"	6-45	35-65
Density, Lb./cu. in.	0.308	0.301
Thermal Conductivity, B.T.U./Sq. Ft./In./Hr./°F. at 68°F.	768	696
Coefficient of Linear Expansion, Average per °F. (77°-572°F.)	0.0000112	0.0000108

TWO TYPES OF DEZINCIFICATION IN NONARSENICAL CONDENSER TUBES

(approx. 120X)
LAYER-TYPE DEZINCIFICATION on the inner wall of an uninhibited Admiralty metal tube from an oil refinery using polluted fresh water.

(approx. 17X)
PLUG-TYPE DEZINCIFICATION on the inner wall of an uninhibited Admiralty metal condenser tube from a power plant operating on tidewater.

ANACONDA®
Tubes and Plates for Condensers and Heat Exchangers

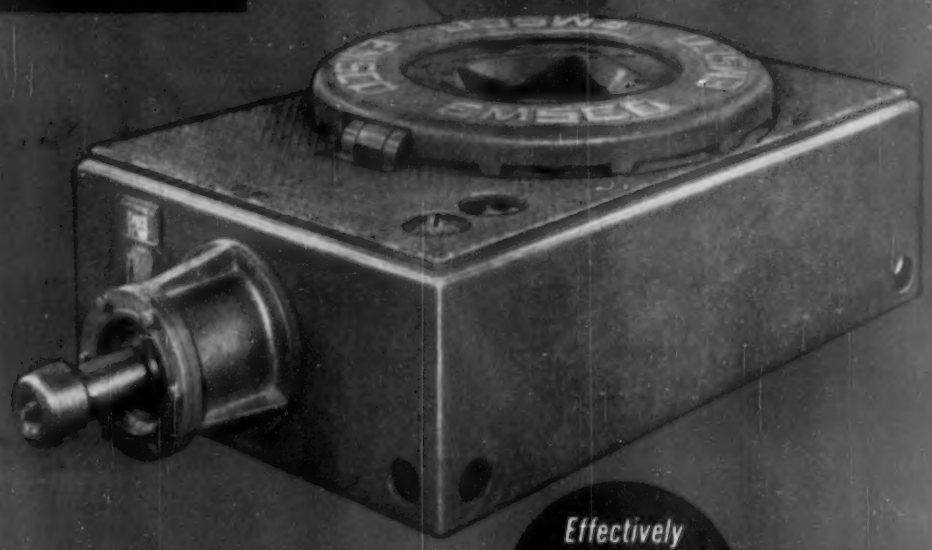
EMSCO

ROTARY TABLES

Safe

Dependable

Fast



are designed for

LONG LIFE

and superior performance

Effectively sealed against entry of mud and other foreign materials

Tested in the factory and proven in the field, Emsco "P" Series Rotary Tables are compact, efficient, economical.

Labyrinth seals between table and base effectively prevent mud from entering working part of table. Mud flinger also helps keep mud from working parts.

Table guard provides convenient foot rest and acts as safety device.

Large central oil reservoir assures positive lubrication.

Call your nearest Continental store and learn more about the many advantages, sizes and types.

CONTINENTAL

Serving the Oil and Gas Industries

CONTINENTAL SUPPLY COMPANY

A Division of The Youngstown Sheet and Tube Company

General Offices: Dallas, Texas

Representatives in all principal oil fields of the world

QUALITY IS OUR PRODUCT

EMSCO

TRADE MARK

EMSCO MANUFACTURING COMPANY

A Division of The Youngstown Sheet and Tube Company

Garland, Tex. • LOS ANGELES, CALIF. • Houston, Tex.

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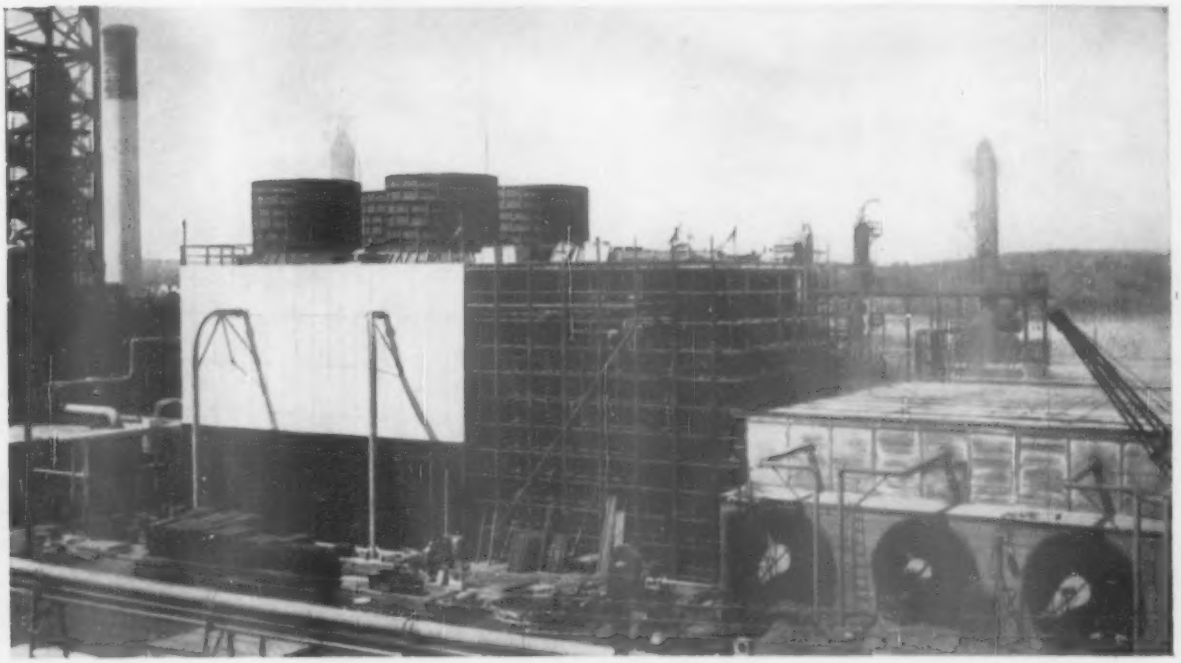
PTR-2

MORE COLD WATER for D-X Sunray



New FW Cooling Tower replaces original forced-draft installation—gives 80% more cooling capacity on same foundation

A NEW eighteen cell Foster Wheeler induced draft cooling tower is shown at the left, above, during construction at the West Tulsa refinery of D-X Sunray Oil Company.

The tower was built in sections over the basin previously used for a Foster Wheeler forced draft tower shown at the right. New cells were put on stream as completed and the remaining cells of the old tower continued to operate until demolished. In this way the heat load was carried successfully through the summer without any shut-down during erection.

The new induced draft cooling tower, occupying the *same* ground area, has 80% more cooling capacity than did the original forced draft installation.

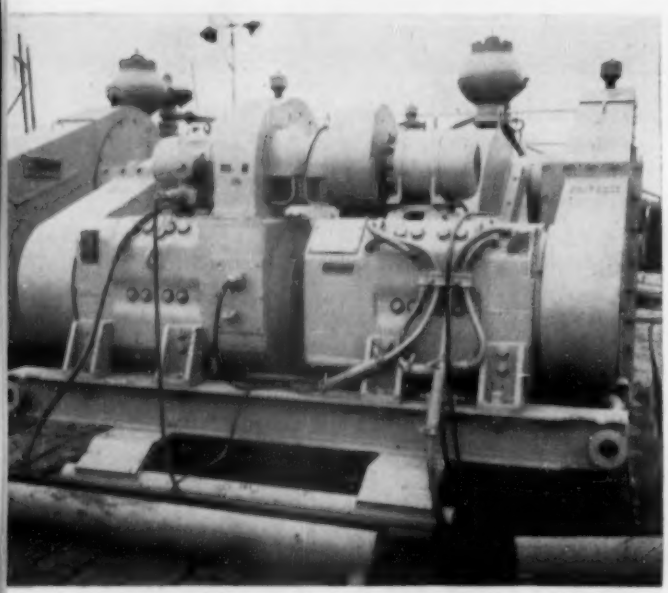
The high cooling efficiency, low drift losses and rugged, all-redwood construction of the completely new line of FW induced draft cooling towers mean lasting economy and dependability in year-round service.

For complete information, send for a copy of new Bulletin No. CT-56-11. *Foster Wheeler Corporation, 165 Broadway, New York 6, N.Y.*

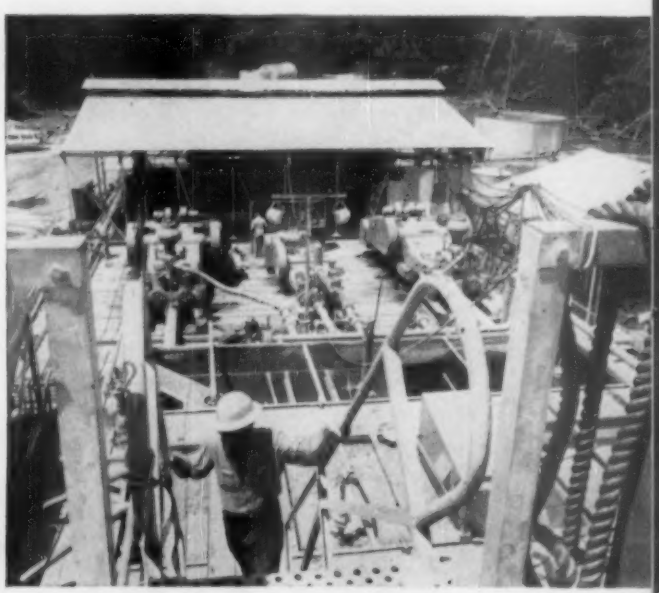
FOSTER WHEELER

NEW YORK • LONDON • PARIS • ST. CATHARINES, ONT.

Three skid-mounted Electro-Motive Diesel generating sets rated at 875-hp. supply power for motor driven pumps, rotary table and draw works. Each unit is complete with two 500-kw generators, controls and cooling system.



Drive motors are 625-hp. direct current type for smooth, rapid acceleration of loads and positive control of speed and torque. Each main pump has two 625-hp. motors for a total horsepower rating of 1,250.



Simple, flexible conductors connect generating sets to drive motors, allowing complete flexibility of arrangement. Rig-up time is reduced considerably because components are located to fit the site.

It's Diesel-Electric for Shell on Cote Blanche Island

Portable, rapid-setup Electro-Motive Power choice for big rig in rugged Louisiana swamp

To work the swampy Cote Blanche Island field, Shell Oil Company faced two opposing requirements for their Rig 11. First, the rig had to be big, with power to drill over 18,000 feet. And second, it had to be easily portable to enable movement over primitive roads.

Shell's decision to use Diesel-Electric was influenced by the fact that this type power permits gathering almost all equipment into easy-handling, skid-mounted packages. In spite of rough terrain, rig-up can be completed in record time.

Electric conductors running from generating units to drive motors provide flexibility in locating equipment to suit conditions. This design avoids clutter, reduces rig-up and rig-down time and makes a big rig far more economical to move. Also, with few modifications, equipment can be adapted for offshore drilling.

Three Electro-Motive SR-8, 875-hp. Diesel generating units driving nine 625-hp. d.c. motors provide the drilling power for Rig 11. Its first hole is scheduled for 18,500 feet, using a 14,000 foot, 9⅝ in. protective string. It takes big power to drill below the overhang of the salt dome in this area, and this rig has it.

Electro-Motive Power is adaptable to many different types of drilling devices on land or water. For complete details on how it might fit your own particular requirements, get in touch with your Electro-Motive representative.

ELECTRO-MOTIVE DIVISION · GENERAL MOTORS

LA GRANGE, ILLINOIS *In Canada:* General Motors Diesel Limited, London, Ontario

Petroleum industry sales offices: Tulsa, Oklahoma; Houston, Texas; Dallas, Texas; Morgan City, Louisiana; Pasadena, California.

Driller's control is located next to draw works. From a central position, driller has complete control of Diesel-Electric equipment, including engine speed, pumps, hoist, rotary table and safety shutdown.

Derrick on Rig 11 is a big one—147 feet. It was modified for platform drilling, but can be extended to 189 feet. In spite of size, the rig is highly portable. Skid-mounted equipment gathers into easy-handling packages.

"he's drilled over 60 miles so far...with just one set of U. S. Rainbow V-Belts," says "Red" Royal

"Red" is talking about "Catline" Dodson, a young contractor who has only one rig, so breakdowns to him are murder.

In the past 4½ years "Catline" Dodson (of Edmond, Okla.) has shifted his rig over 75 times, drilled a total of 320,000 feet so far—with the *same set* of U.S. Rainbow® V-Belts on a *compounded* mud pump drive. "It might take me up to 6 hours to replace a broken set of belts," he says, "and I figure my downtime at about $50 an hour. But U.S. Rainbow V-Belts have never failed me, not even in the near-zero temperatures. The set has so far drilled over twice the footage I'd estimated."

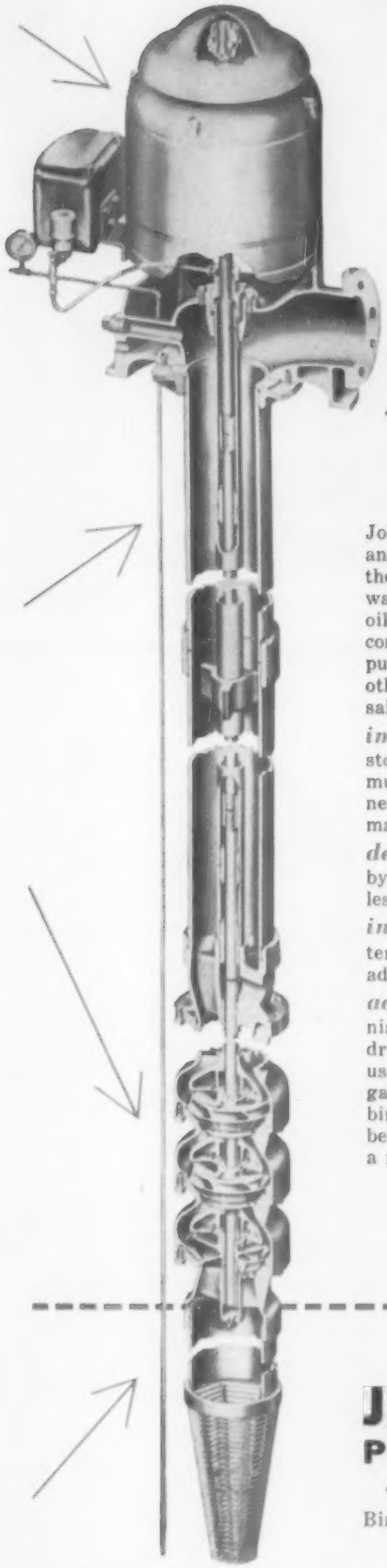
"Red" Royal knows many a toolpusher who will tell you Rainbow V-Belts are unbeatable for reliability. Each belt has the unique Equa-Tensil Cord Section that enables each cord to pull its full share of the load, for extra power. Your drilling dollars deliver *more* when you have "U.S." V-Belts, and other quality "U.S." oil-field products.

Available in all fields at supply stores.

Driller I. L. Dodson checking one set of U.S. Rainbow V-Belts.

Mechanical Goods Division

United States Rubber



ANY WAY YOU LOOK AT IT—

you can't beat a dependable

JOHNSTON Vertical Turbine PUMP

Johnston Pumps have an enviable record of field-proven performance, operating under widely varying conditions. The versatility of the Johnston Line makes these pumps ideally suited for primary water supply from wells, lakes or rivers...for domestic supply in oil field camps...for water flooding work...for cooling towers, condenser pumping, booster pumps, transfer pumps, circulation pumps, sump pumps...for handling water volatile fluids and many other liquids such as sulphite liquor, sulphuric acid, chlorine, brine, salt water, and caustic liquids.

improved, scientific design The scientific design of Johnston Pumps has been tested under every type of industrial, municipal, and agricultural condition throughout the world for nearly 50 years. Constant research and design improvements have made these good pumps even better.

dependable, low cost operation Johnston Pumps are built by master craftsmen of the best materials to stand up longer with less maintenance and power costs.

interchangeable parts Simplicity of construction and interchangeable parts make Johnston Pumps highly flexible and adaptable to many types of pumping conditions.

adaptable to any power source Johnston Pumps are furnished for use with any type of power. Integral electric motor drives, right angle gear drives, and flat or V-belt pulleys may be used. Either belt or gear drives are ideal for gasoline, diesel, or gas engines. When a continuous water supply is essential, a combination of an electric motor with either a right angle gear or belt drive will give positive insurance against a loss of water as a result of power failure.

It will pay you to learn more about dependable Johnston Pumps. Fill in and mail coupon today.

JOHNSTON VERTICAL PUMPS

JOHNSTON PUMP COMPANY

A Division of The Youngstown Sheet and Tube Company

Bin "K," Pasadena 15, California

☐ Please Send Bulletin

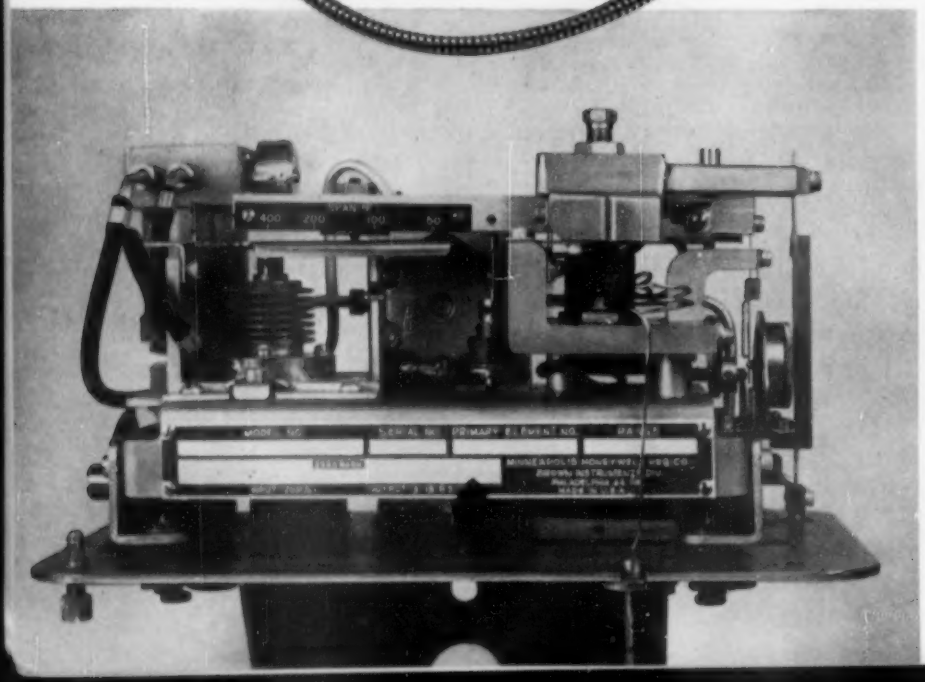
☐ Have Representative Call

Name _____

Address _____

City _____ Zone _____ State _____

You can mount the transmitter at the point of measurement, either indoors or out. A sturdy, weather-proof aluminum cover protects all working parts and adjustments.



Interior view of the transmitter shows the accessibility of all parts. Span and zero adjustments are easy to make, and no changes of parts are required.

only the

TEL-O-SET transmitter–

gives you full rangeability

without changing parts

THE *Tel-O-Set* transmitter offers complete versatility. This highly accurate force-balance instrument measures temperature, gage pressure or absolute pressure, and transmits a proportionate output signal to a receiver or controller. It requires only one thermal system and one pressure system for all ranges, and changeover from temperature to pressure measurement is extremely simple.

You can adjust the span to any values between 20 and 150 psi, or 50 F and 400 F. And you can shift the span to cover any part of the overall transmitter range . . . from 40 to 600 psi, or from —375 to 1000 F . . . *without changing parts.*

The *Tel-O-Set* transmitter is unmatched in performance. It's just as accurate at small spans of 20 psi and 50 F as at wide spans of 150 psi and 400 F. It responds swiftly to changes in temperature or pressure to give you control within close tolerances. It's effectively compensated for ambient temperature and pressure, and fully protected against the effects of vibration.

While offering the best in transmitter performance, the multi-purpose *Tel-O-Set* saves you the expense of stocking an assortment of thermal and pressure systems or spring assemblies . . . and simplifies the training of your operators and maintenance men.

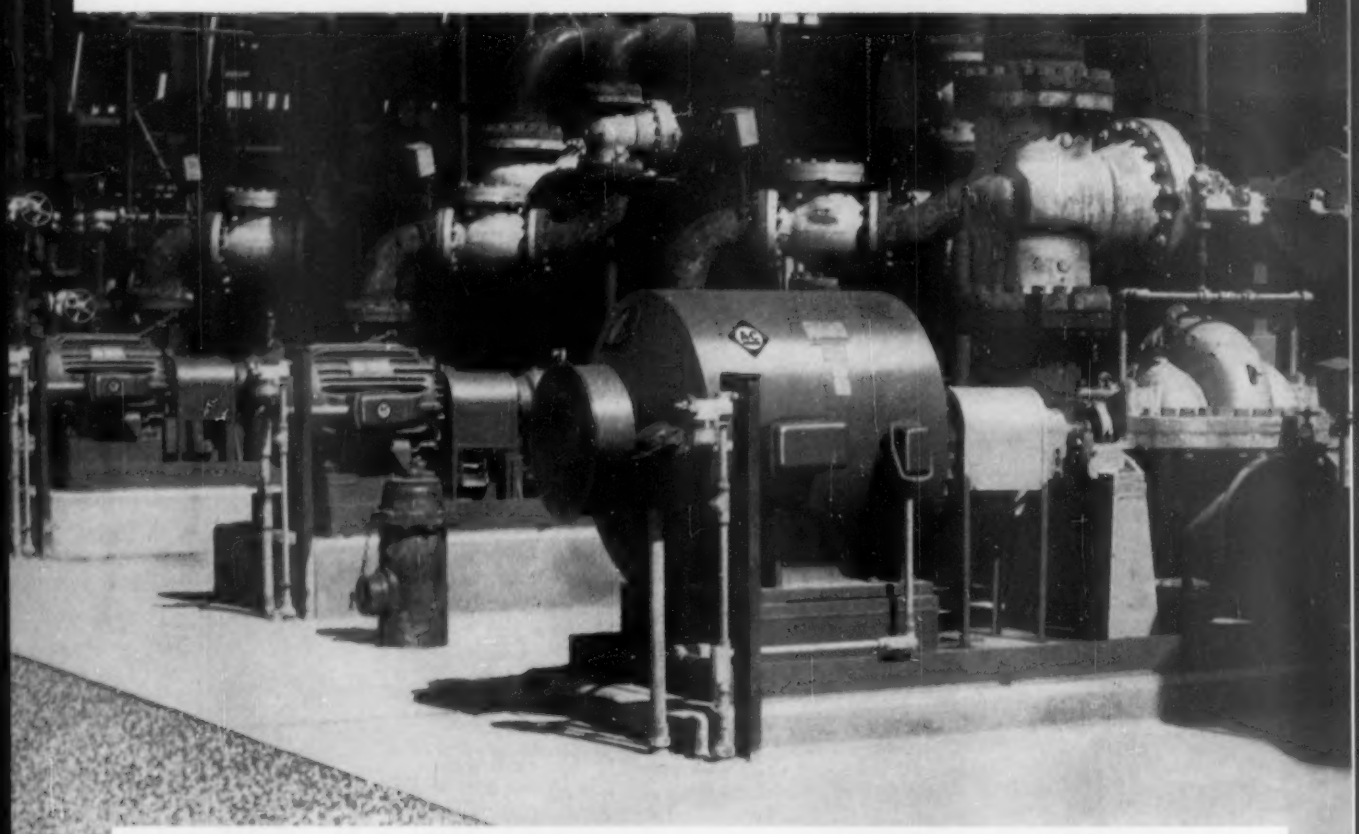
Get complete details on *Tel-O-Set* transmitters . . . and related *Tel-O-Set* miniature indicators, recorders and controllers . . . from your nearby Honeywell sales engineer. Call him today . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.—in Canada, Toronto 17, Ontario.

• **REFERENCE DATA:** Write for Specification S1003-1.

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS
First in Controls

for more continuous processing—
Another great refinery installs
ALLIS-CHALMERS MOTORS



Thousands of horsepower in Allis-Chalmers motors will drive processing equipment at Tidewater Oil Company's new Flying A Refinery, near Delaware City, Delaware.

Designed and constructed by C. F. Braun & Co., consulting engineers and contractors, this plant will process 130,000 bbl of crude oil per day. The largest ever built in a single construction operation, this huge refinery joins a growing list of major petroleum plants in which Allis-Chalmers equipment is used. Main reason for this trend:

Continuous Operation

● **Ribbed Construction** of smaller motors gives up to 43% more cooling surface when compared with ordinary motors. *Tube-Cooled* design in larger sizes permits free flow of air. BOTH designs result in fewer winding burnouts.

● **Motors** are of the chemical type, designed for use in refinery operations.

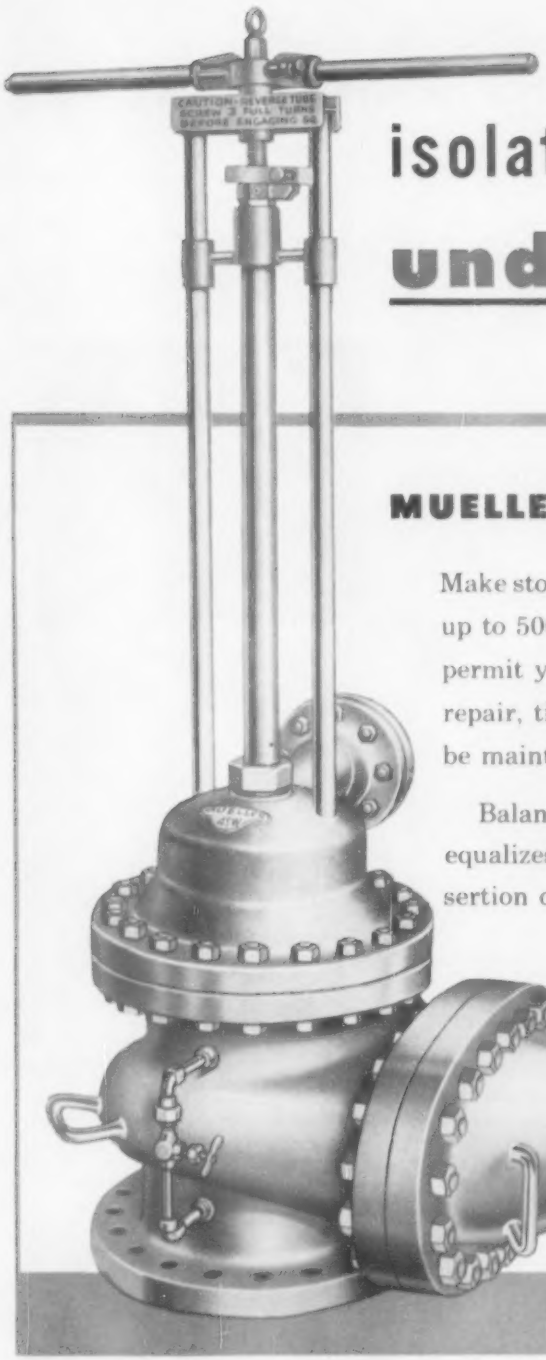
● **Stators** receive more than the usual dips and bakes. They get extra dips and bakes plus two coatings of red enamel to provide maximum electrical life.

* * *

FIND OUT MORE about Allis-Chalmers motors for the petroleum industry. Contact your nearby A-C sales office, or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

A-5185



isolate line sections... under pressure!

MUELLER® No. 4 Line Stopper Unit

Make stop-offs on 10" and 12" lines under pressures up to 500 p.s.i. Mueller No. 4 Line Stopper Units permit you to isolate a complete line section for repair, tie-in or relocation. If desired, flow may be maintained, through an independent by-pass.

Balancing pressure valve in completion plug equalizes pressure in fitting, permitting easy insertion or removal of plug.

NO-BLO

Write for complete information on the No. 4 Line Stopper Unit. If you have only a limited amount of work to be done you may be interested in our rental plan.

MUELLER CO.

Dependable Since 1857

MAIN OFFICE & FACTORY DECATUR, ILLINOIS

Longer tandem life

One of 9 reasons why oil men find International Trucks cost least to own!

In any off-highway truck operation, you need a tandem and other major components built to stand up and take it, to keep costs way down.

And cost records prove* that over the years International Trucks cost *least* to own!

The reason is simply this: It is International policy to build trucks that do the job better, do it longer at lower cost than any other make—International spends more to build the truck so it costs you *least* to own.

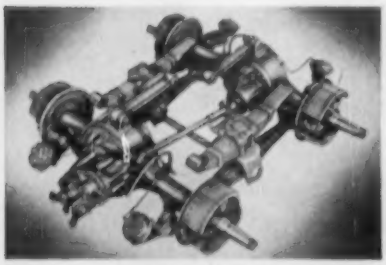
That's why there are more owners of Internationals than any other 6-wheel truck, and have been for the past 21 years!

The way to trim your trucking costs is to get together with your International Dealer, today. He's right at the other end of your phone.

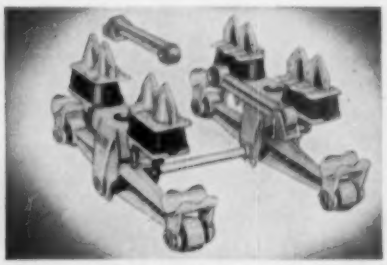
**Signed statements in our files, from fleet operators throughout the U.S., back up this statement.*

INTERNATIONAL HARVESTER COMPANY, CHICAGO

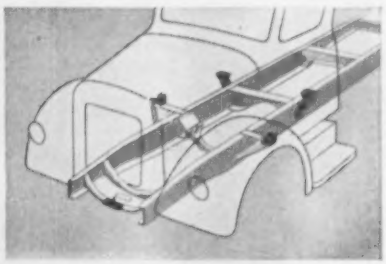
Motor Trucks • Crawler Tractors
Construction Equipment • McCormick® Farm Equipment and Farmall® Tractors



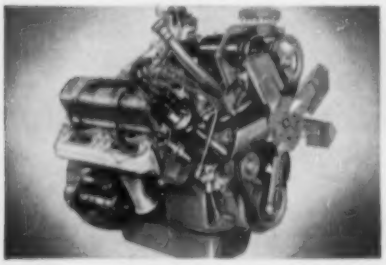
1 All International tandems give longer, more dependable life. This unit has rubber bushings at all 10 oscillating points to reduce maintenance and lengthen life. Third differential with lock transmits power smoothly and evenly to each axle.



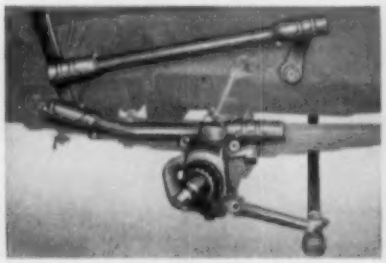
2 Lightweight suspension with rubber load cushions provide soft, easy riding, empty and loaded. Cushions reduce truck weight and servicing. Optional aluminum walking beams, spring saddles and wheels increase payloads more than 500 pounds.



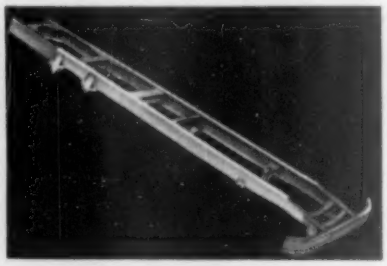
3 For cab comfort and long life. Quiet, level ride without transmitting stress to cab, fenders, hood or radiator is the result of wide spaced, rear shackle type mountings in an exclusive International 5-point rubber-insulated V-8 cab suspension.



4 Most powerful, most economical V-8's under any truck hood—206, 226 and 257 hp. Responsive power that gets your loads moving *fast*, keeps them moving. More miles per gallon of gas. Other gasoline, LPG and diesel engines up to 356 hp.



5 True geometric steering provides easier handling, outstanding maneuverability with short turning circles. Gears are cam and roller mounted twin lever type. Controls mounted *ahead* of the front axle. Steering wheel is comfortably positioned.

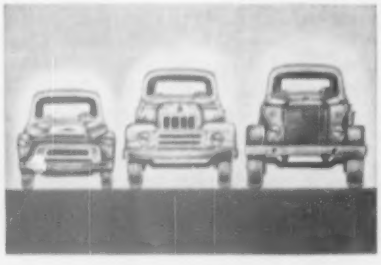


6 Steel-Flex frames combine great strength with flexibility. Heavy-duty construction plus reinforced crossmembers with husky gussets provide for proper tandem suspension. Inverted L-type reinforcements give full load-length support.

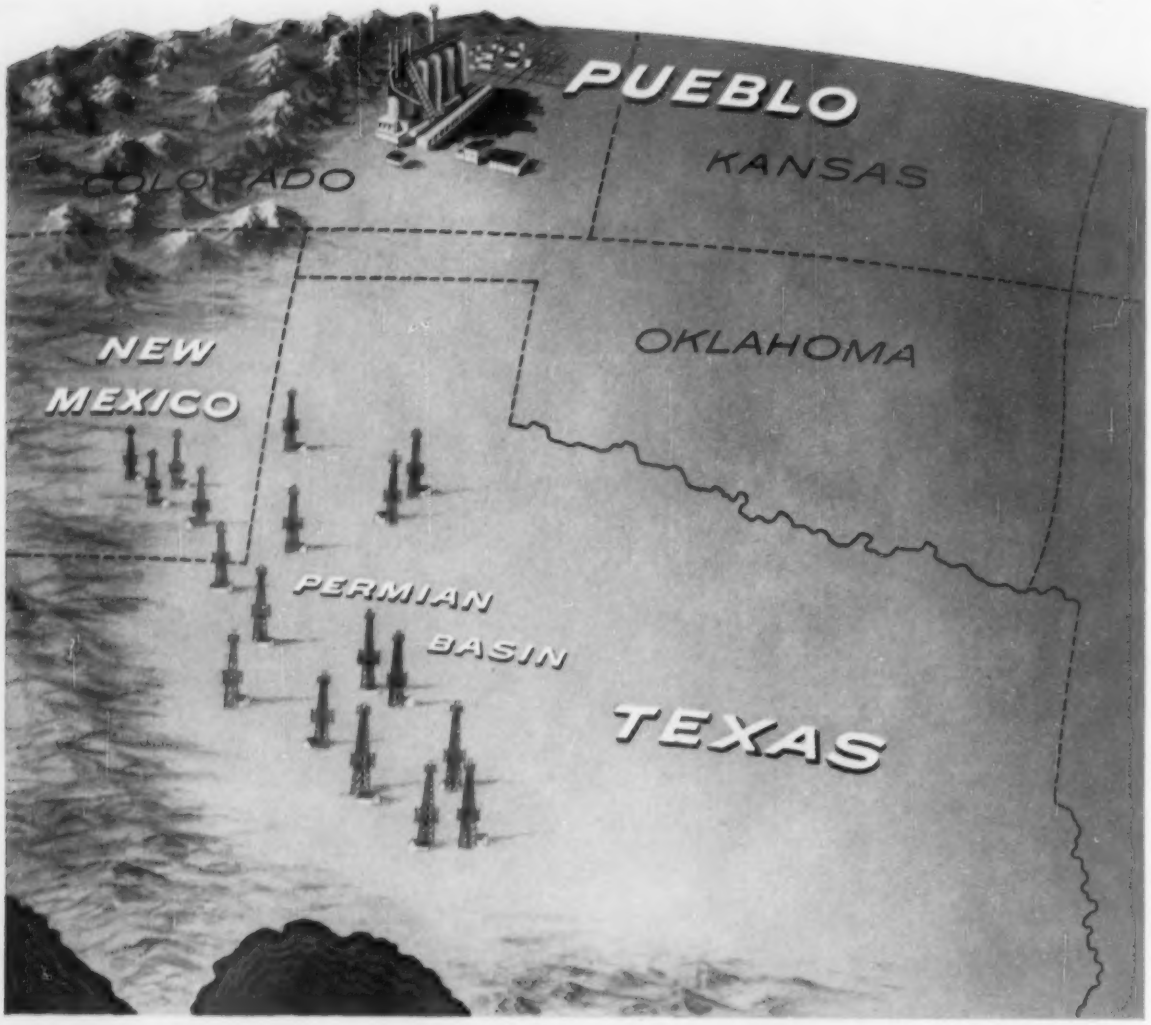
International builds six-wheel models from 22,000 lbs. GVW to 76,800 lbs. GCW in conventional and COE design. There is one practically custom built for your job. Engines range in sizes up to 1091 cu. in.—famous sixes and three great new V-8's. Complete selection of all-wheel-drive models also available to make the toughest going easy. You name the job, International has exactly the right truck for it—the truck that costs you *least* to own.

7 New "silent spin" center bearings have quiet, tapered roller bearings. Prelubricated, sealed and shielded for long, trouble-free operation. Self-aligning, wide spaced rubber mountings dampen noise and vibration, eliminate service.

8 All-wheel-drive models have the extra traction and pull needed for all tough, off-highway operations. Completely factory-built, 7,000 to 33,000 lbs. GVW. Low height with ample ground clearance. Complete selection of equipment available.



9 World's most complete line. There is an International "tailor-made" for every truck job, ½ tonners to 90,000 pounders. Choice of 4-wheel, 6-wheel and all-wheel-drive models, conventional and COE design. Every one built to cost *least* to own.



you'll see

CF&I SEAMLESS CASING AND TUBING

all over the Permian Basin...

Rig operators in the Permian Basin know from first-hand experience that CF&I is a desirable source for top-rate seamless oil country casing and tubing. For—ever since it opened its modern tube mill at Pueblo—CF&I has enjoyed the privilege of serving this important production and exploration area.

Oil men all over the West will tell you the same story. CF&I Seamless Casing and Tubing is top quality. CF&I controls every phase of operations required in the manufacture of its seamless casing and tubing—from the mining of its raw materials to the finished product. This step-by-step control assures a product of high quality.

Available in standard sizes from 2⅜" to 9⅝" O.D., CF&I Seamless Oil Country Casing and Tubing meets or exceeds API STD 5A specification. Ask your CF&I representative for the complete story today.

CF&I

SEAMLESS TUBULAR PRODUCTS

THE COLORADO FUEL AND IRON CORPORATION

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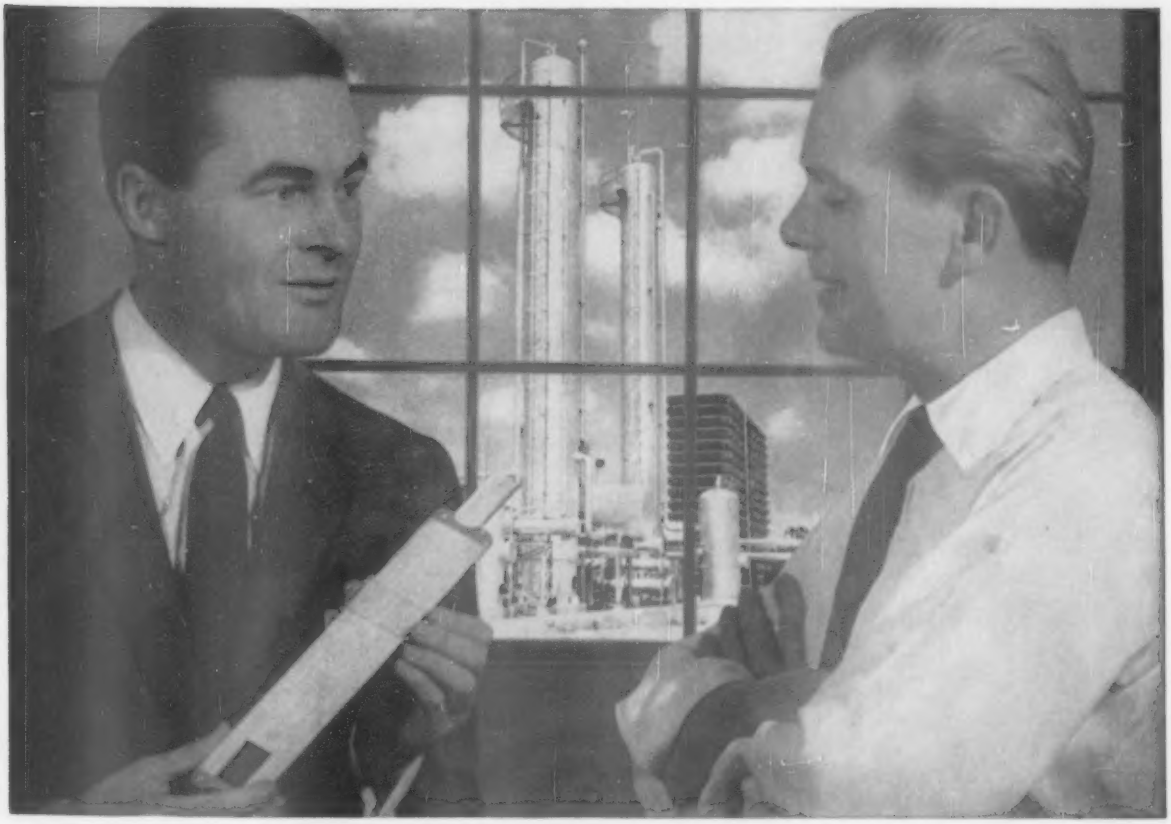

You get more than gas treating chemicals from CARBIDE...

CARBIDE's mono- or diethanolamine give you excellent removal of CO_2 and H_2S. By converting the extracted H_2S to sulfur or H_2SO_4, you benefit by recovering a valuable product—thus reducing your operating costs.

CARBIDE's di- or triethylene glycol remove H_2O economically from gas streams. The low initial investment and low operating costs of glycol type plants provide minimum dehydration charges.

Plus Benefits

- Technical data gathered from 22 years experience producing and supplying gas treating chemicals. These data can help you in construction of new facilities, the enlargement of present equipment and in securing trouble free performance of existing plants.
- Technical help from field representatives and service laboratories.
- Fast delivery from warehouses located near major gas fields.
- Constant source of supply.

Find out for yourself how CARBIDE can help you. Write today to Carbide and Carbon Chemicals Company, Room 308, Department H, 30 East 42nd Street, New York 17, New York.

In Canada: Carbide Chemicals Company, Division of Union Carbide Canada Limited, Montreal. In Western Canada: Harrisons and Crossfield.

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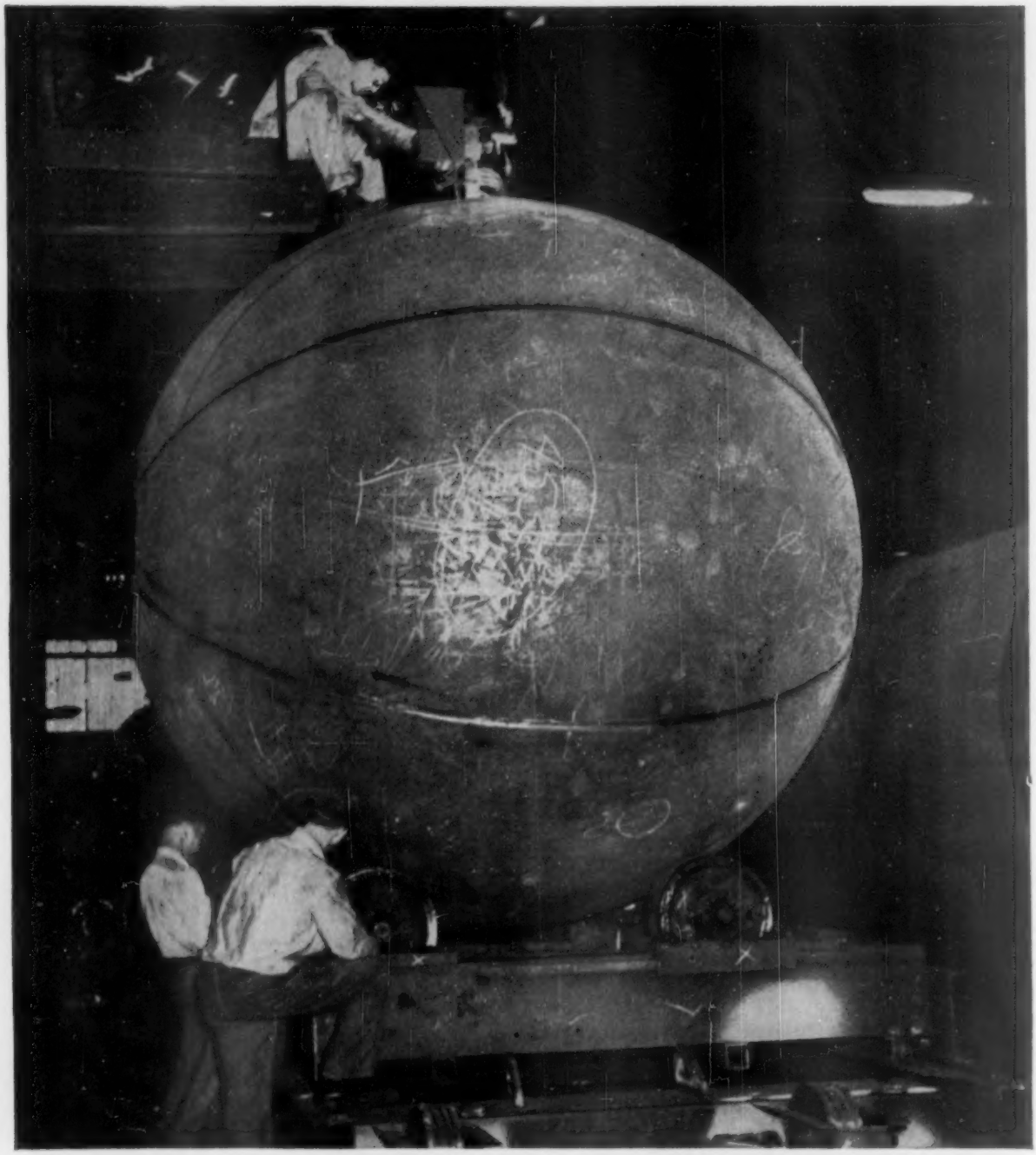


NEED A KING-SIZE BASKETBALL?

This one is a spherical reactor operating at 650 psi and 850°. Graver ingenuity and skill fabricated the carbon steel outer shell, lined it first with 6″ of gunite, then with Type 321 stainless steel interior and fittings. For precision-built pressure vessels in alloys or carbon steel, call on Graver.

GRAVER

GRAVER TANK & MFG. CO., INC.

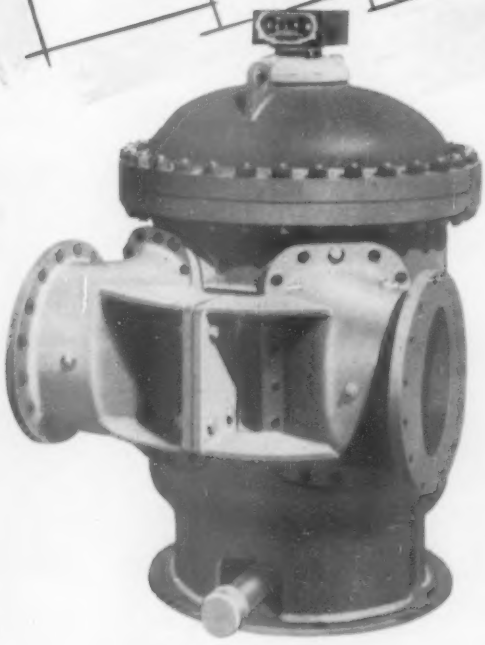
EAST CHICAGO, INDIANA • NEW YORK • PHILADELPHIA • EDGE MOOR, DELAWARE
PITTSBURGH • DETROIT • CHICAGO • TULSA • SANDS SPRINGS, OKLAHOMA
HOUSTON • LOS ANGELES • FONTANA, CALIFORNIA • SAN FRANCISCO

Here it is, the B-700

The largest rotary positive displacement meter known today — measures a barrel of liquid per revolution — at new accuracy for tanker and pipeline service

Capacity...

10,000 barrels per hr!



New dual case 16" meter utilizes principles proved on other A. O. Smith meters. Temperature compensated with gravity selection . . . remarkably smooth and quiet operating. Reduces investment in tank storage capacity . . . provides peak accuracy . . . speeds tanker turn-around time and line flow rate. For details on the B-700, see your representative or write —

Through research A.O. Smith *. . . a better way*

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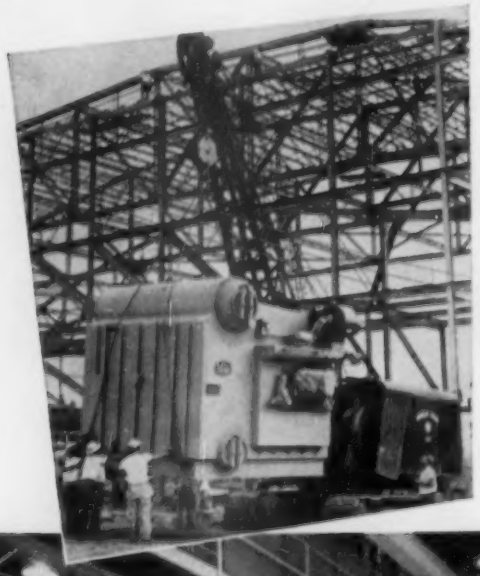
CORPORATION

METER PRODUCTS

Factories: 5715 Smithway St., Los Angeles 22, Calif., P. O. Box 500, Succasunna, N. J. Offices: Atlanta, Ga., Chicago 7, Ill., Houston 20, Texas, Los Angeles 22, Calif., New York 17, N. Y. Canada: Toronto 12, Vancouver 1. International Division — Milwaukee 1, Wisconsin

Look for this honored Name Plate . . .

a guide to advanced designs in package unit and custom built steam generating equipment



Vogt steam generating units are available in types and sizes to meet individual plant needs for power, processing or heating.

Package units range from 10,000 to 40,000 pounds of steam per hour while custom built units are obtainable in the larger capacities. Available in bent tube types and straight tube, forged steel sectional header types for solid, liquid or gaseous fuels burned singly or in combination.

Write for Bulletins, Dept. 24A-BO

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Box 1918, Louisville 1, Kentucky

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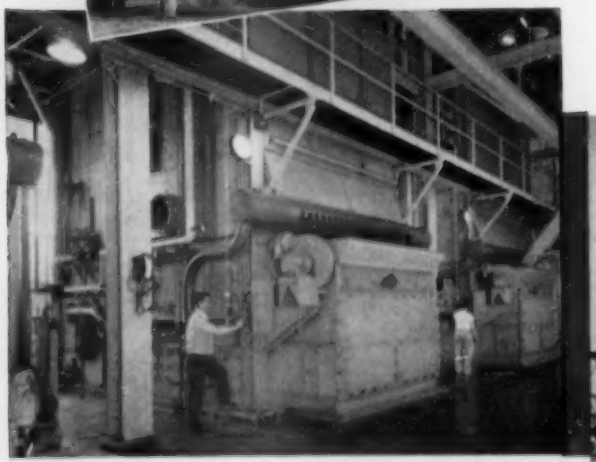
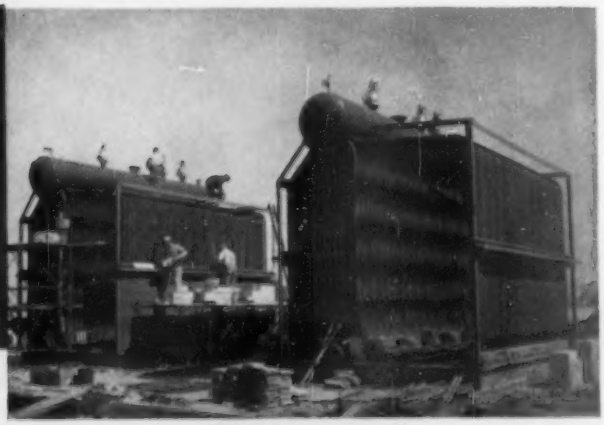


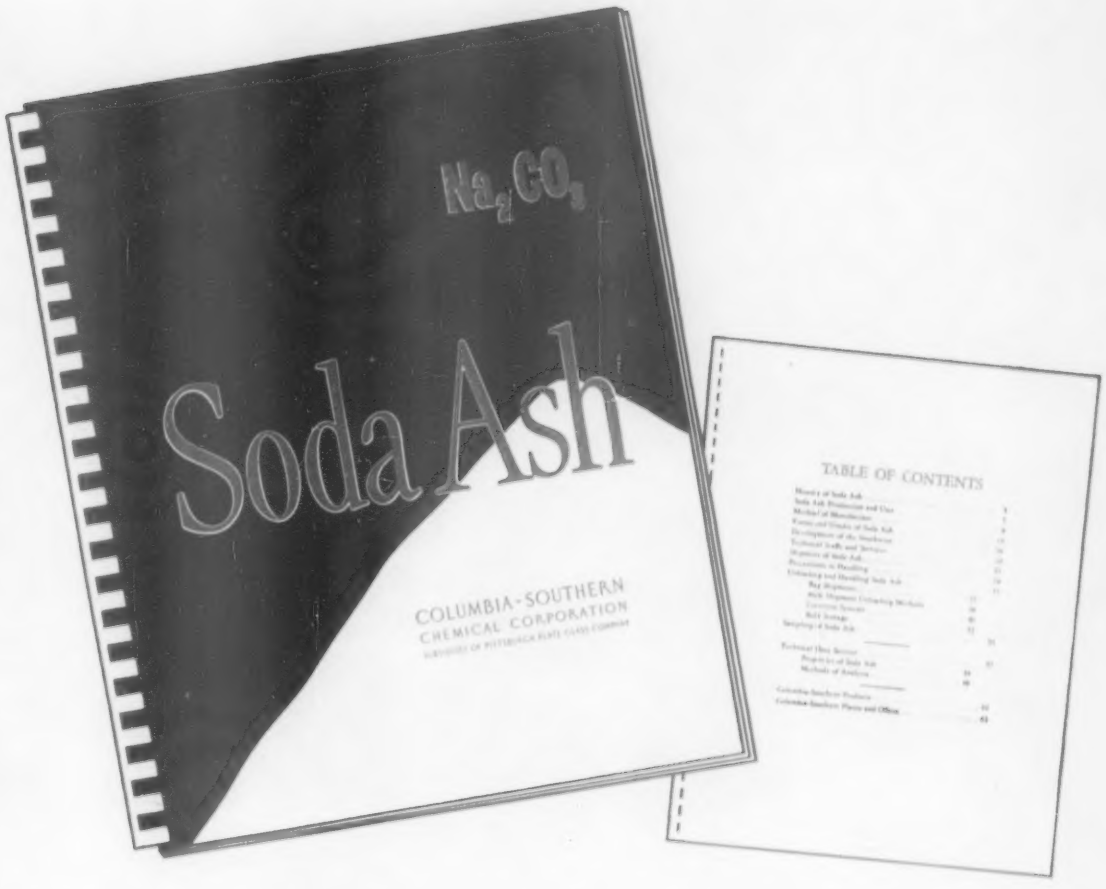
One of three 15,000 #/hr. capacity package unit steam generators for a State institution.

Two of three 41,000 #/hr. steam generators installed in Medical Center Steam Plant, Louisville, Ky.

Erecting two 50,000 #/hr. steam generators at Kelly Air Force Base, San Antonio, Texas.



OTHER VOGT PRODUCTS
Drop Forged Steel Valves, Fittings and Flanges in a complete range of sizes • Petroleum Refinery and Chemical Plant Equipment • Steam Generators • Heat Exchangers • Ice Making & Refrigerating Equipment



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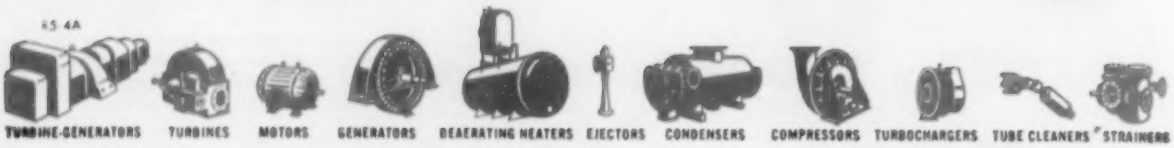
Two Elliott 800-hp, 180-rpm synchronous motors drive these horizontal duplex reciprocating compressors in a large mid-western steel mill.

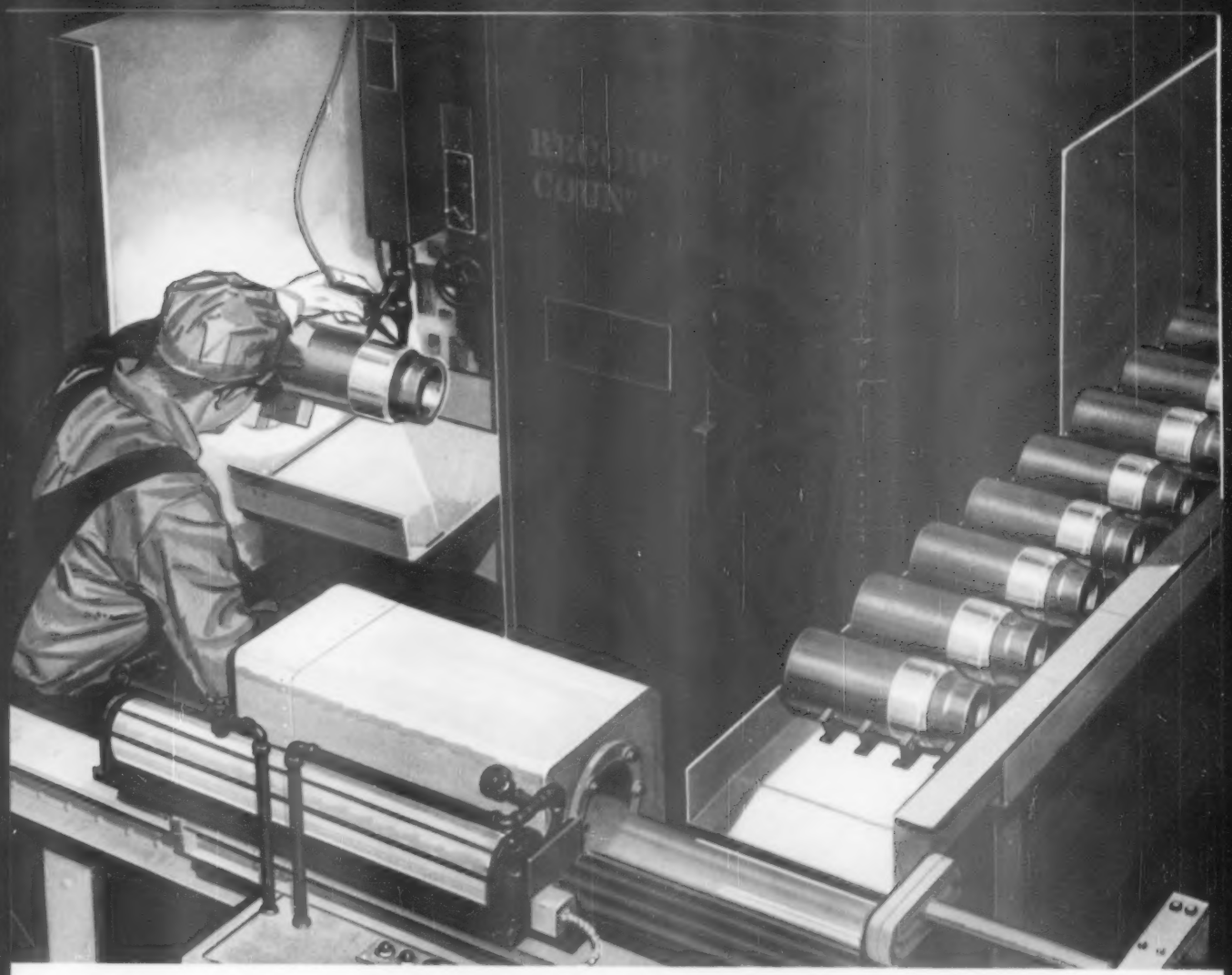
ELLIOTT SYNCHRONOUS MOTORS

Engine-type rotors can be split (hub and rim) or the hub only may be split. Ballast rings can be added when additional inertia is necessary

team up perfectly with compressors to assure top operating efficiencies. This teamwork is no accident. The complexities of compressor drives require the most careful engineering design and compressor application experience. Elliott has this background as attested by hundreds of successful installations. Such factors as starting torque and current, suitable flywheel effect, as well as power factor correction, are carefully analyzed. The result is the kind of performance that has earned a reputation for Elliott in large synchronous motor compressor drives. Contact your nearest Elliott Field Engineer for full details or write Elliott Company, Ridgway, Pa., for Bulletin PB 5000.

ELLIOTT Company





NEW HARDFACING METHOD MAKES SPANG® TOOL JOINTS LAST LONGER

The result of this production line is a boon to drillers operating in abrasive formations. SPANG Hardfacing is applied to Spangweld and SPANG Double Seal tool joints—through a highly effective method which provides greatest possible wear resistance.

The process, pioneered by National, is almost entirely automatic. Each joint is first pre-heated, to insure an ideal bond between the parent metal and hardfacing material. Then multiple bands of tungsten carbide are *continuously overlapped* on the scale-free surface to form a solid band. Applied by tungsten-arc, inert gas welding equipment, the particles penetrate deep into the surface of the joint. Their flow rate is automatically controlled to produce a sufficient, uniform deposit. After welding, each joint is stress relieved.

Because this application method produces a continuous band, any wear on the hardfacing simply exposes a new surface equally resistant to abrasion! For varying drilling conditions, "Banded Medium Density" and "Banded High Density" hardfacings are available. Both offer the same basic benefit: tool joints that last longer under the toughest abrasive punishment.

Next time you have a drilling job in an abrasive formation, remember the extra insurance of SPANG Hardfacing . . . as well as SPANG tubular products. Call on us at any time for details and assistance. Helping you do the best job possible—wherever you're located—is the constant goal of National Supply—world's largest manufacturer and distributor of a complete line of oil field machinery and equipment.

THE NATIONAL SUPPLY COMPANY

REDUCE WELL-SERVICING COSTS WITH SPANG® PLASTIC-COATED TUBING!

SPANG®
EXTREME LINE TUBING

- Provides maximum running speed; fast joint make-up
- Has 100% joint strength
- Provides 100% resistance to leakage
- Has 50% less connections
- Provides positive shoulder contact engagement
- Has a streamlined exterior
- Is available in grades J-55, N-80 and P-105 to suit every well condition

SPANGSEAL

- Has 50% less connections
- Provides 100% resistance to leakage
- Provides more hole clearance
- Eliminates "hanging-up" while running
- Is available in grades J-55, N-80 and P-105 to suit every well condition

THE NATIONAL SUPPLY COMPANY

SPANG-CHALFANT DIVISION

MAIN OFFICE: Two Gateway Center, Pittsburgh 22, Penna.

DIVISION TUBULAR OFFICES: Denver, Colorado; Houston, Texas; Ft. Worth, Texas; Los Angeles, California; Toledo, Ohio Tulsa, Oklahoma; Calgary, Alberta, Canada

NATIONAL BLUE OIL FIELD MACHINERY AND EQUIPMENT
SPANG STEEL PIPE AND ELECTRICAL CONDUIT

You can minimize the major reasons for well-servicing—paraffin accumulation and internal corrosion—by ordering SPANG's special plastic coating for your next string of Spangseal, SPANG Extreme Line, or SPANG API Tubing. With a smooth internal plastic coating in the tubing, paraffin build-up is effectively retarded. And, just as in SPANG Drill Pipe, the plastic coating provides sound protection against corrosion and its costly effects.

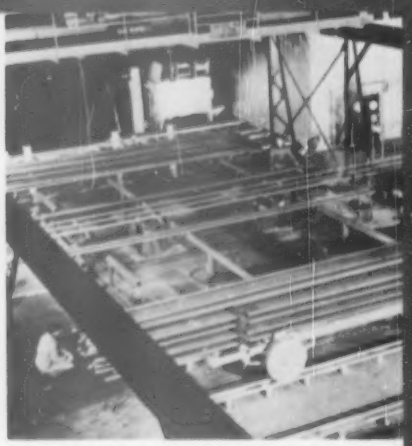
You can see below how SPANG's high quality mill control standards insure maximum service of this plastic coating. SPANG's modern facilities for the unified control of tubular goods and plastic coating constitute the only installation of its kind in the world. Add this quality control benefit to the outstanding features shown on the opposite page, and you have the reasons why SPANG Tubing is your best buy.

See your nearby National Supply representative soon for all details on quality SPANG Tubular Products.

SPANG® plastic coating extends tubing service life!

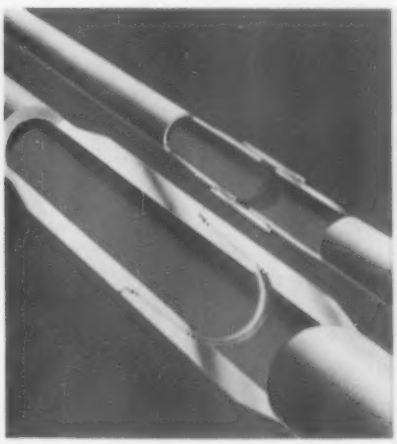
Special spray heads, traveling on a carefully-timed application cycle, apply multiple coats of tough epoxy-phenolic plastic to a minimum of .005 inch thickness.

Between coatings, the tubing is "baked" to set plastic. This completely polymerized coating outperforms linings applied by ordinary methods.



Complete mill-controlled operations and modern facilities assure high quality and maximum field service of Spang Plastic Coated Tubing.

Magne-Gage inspection checks .005 inch minimum coating thickness. Smoothness, adhesion, chamfer coating and completeness of baking are also inspected.



Get complete details on this new Spang Plastic Coating service for your tubing and drill pipe requirements from the National Supply representative soon.

See the next page . . . for the best in general service pipe

SPANG® CW

EASY TO WORK WITH . . .
EASY TO INSTALL . . .
AND READILY AVAILABLE!

The manufacturing care behind SPANG CW makes it easy to work with and install. Thorough tests and inspections before shipping insure its top strength and long service life—features that pay off wherever you put it to work.

In countless oil field applications, SPANG CW has consistently proved itself for dependable general service work. That's because it's made under close quality control conditions—like all the other famous SPANG oil field tubular products.

It is especially useful for water-flooding, air and gas lines, water and oil gathering systems, as well as roof rails, step rails, and other structural purposes.

SPANG CW Steel Pipe is readily available at every National Supply Store in a full range of sizes—and, most important, there's no extra cost for its special quality. Try it on your next job.

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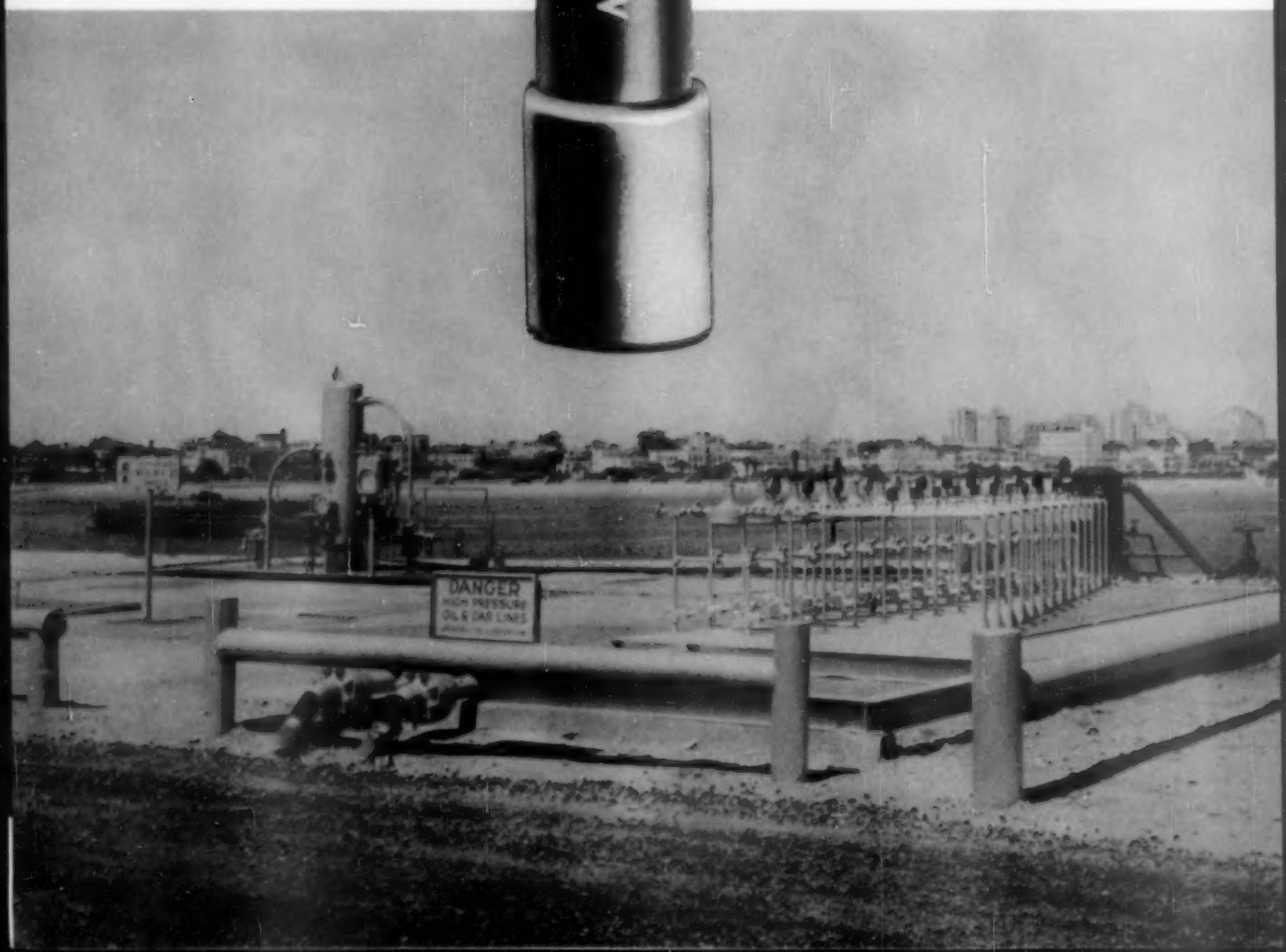

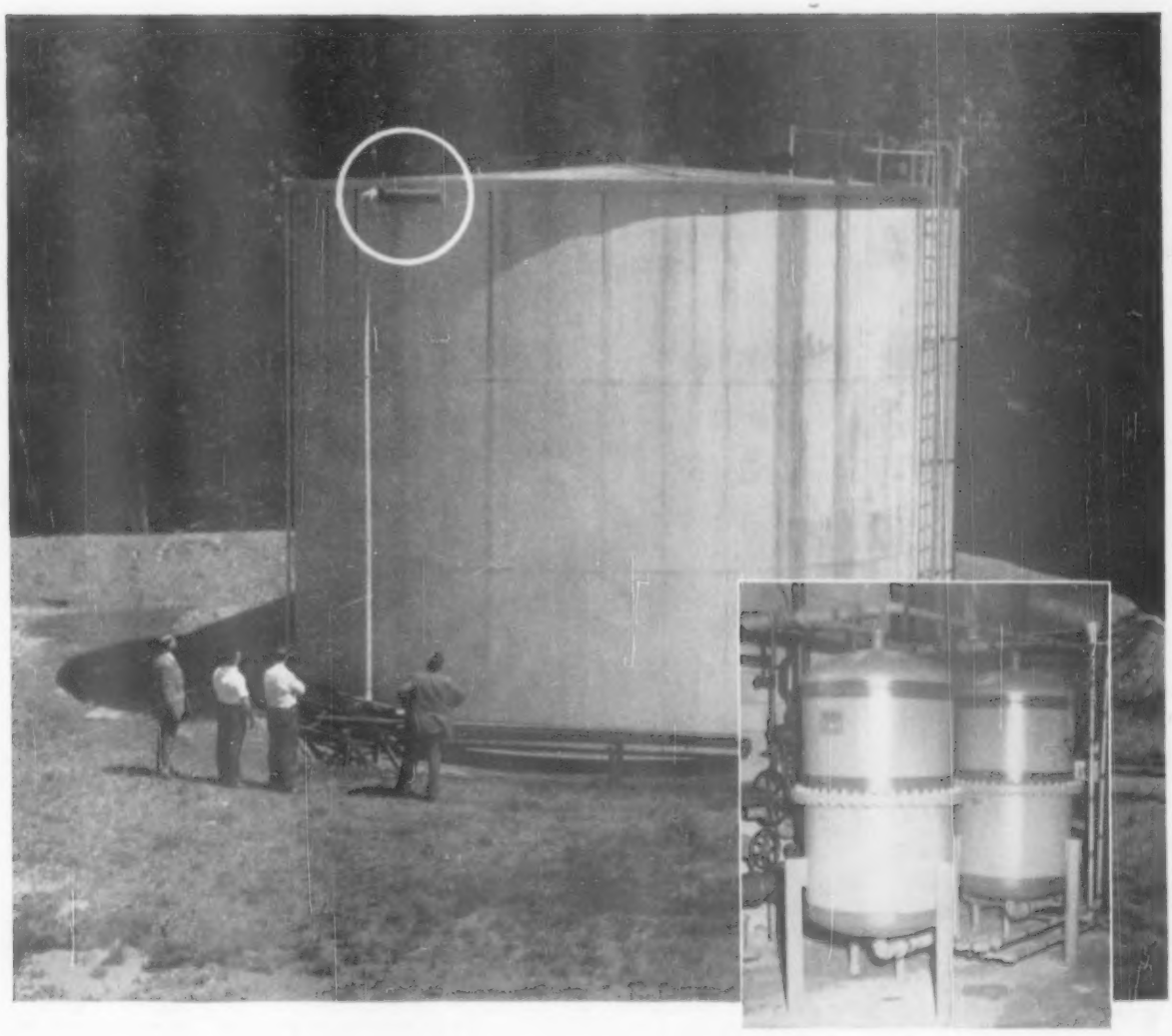

A blanket for this big baby?

Sure . . . it's in the two little tanks . . . a blanket of Foam.

The big tank is full of Styrene, great stuff for the plastics business.

A Styrene fire out of control, like any fire, can be dangerous. The best way to fight it? Throw a blanket of Rockwood FOAM over it.

On top of this big baby full of Styrene is the business end of a Rockwood Fixed FOAM System (in the circle). It'll throw a FOAM blanket over the tank in seconds — if a fire ever starts.

The FOAM liquid is kept, ready to go any time, in the Rockwood diaphragm-type storage tanks on the right.

Do you have a baby like this — full of some flammable liquid? Is a Rockwood Fixed FOAM System ready with a blanket — just in case? Use the coupon to send for the informative booklet.

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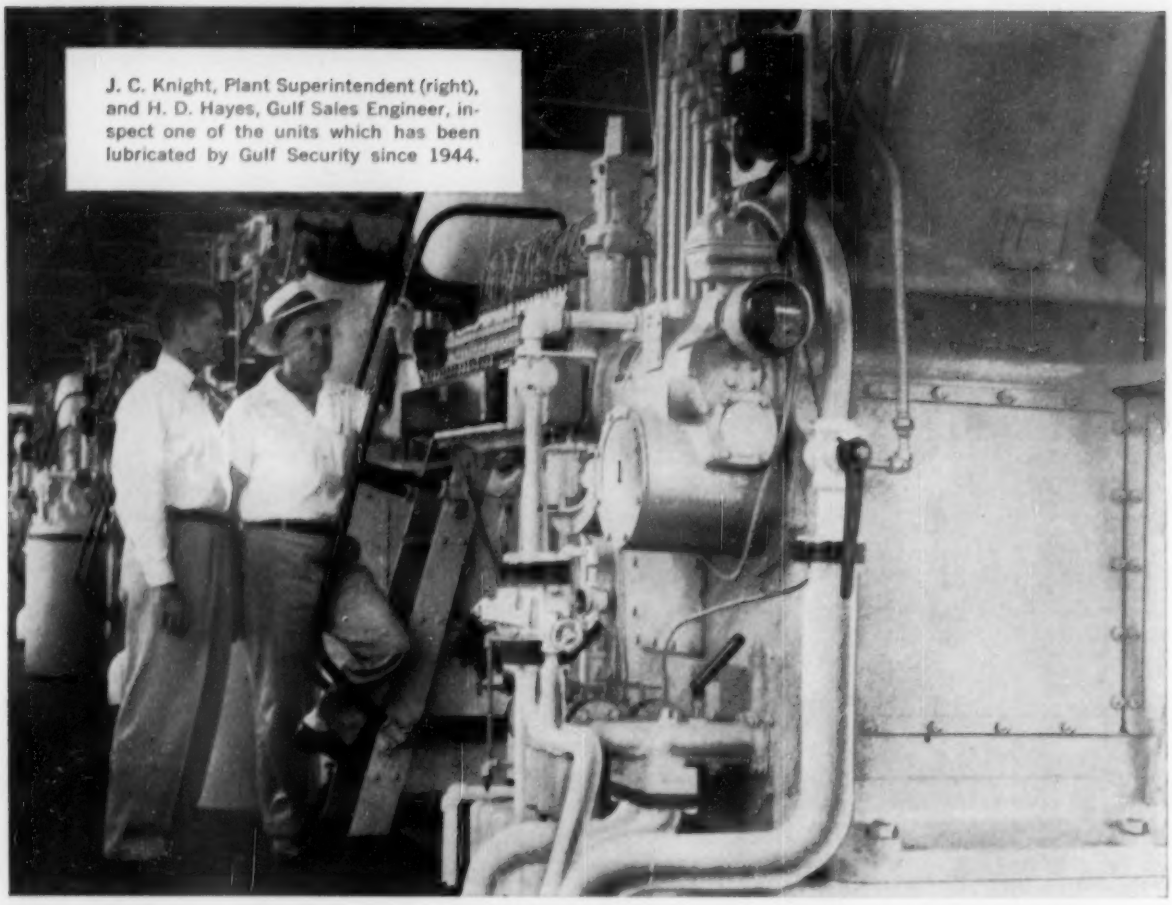

J. C. Knight, Plant Superintendent (right), and H. D. Hayes, Gulf Sales Engineer, inspect one of the units which has been lubricated by Gulf Security since 1944.

At Lobelville Station of Tennessee Gas Transmission Company

12 years of dependable compressor service with GULF SECURITY

With engines totalling 37,500 hp, the Lobelville, Tennesee, station of Tennessee Gas Transmission Company is one of the largest compressor stations in the United States. This station has been lubricated by Gulf Security for the past 12 years.

Gulf Security is a non-additive oil that protects compressor and power assembly cylinders and piston rings against harmful deposits and excessive wear. Like Tennessee Gas Transmission Company's Lobelville station, scores of other transmission plants all over the country are using Gulf Security to prevent operating troubles and keep maintenance costs down.

The Gulf complete "package" includes not only the finest petroleum products and prompt delivery, but also the services of an experienced petroleum engineer to help you with *any* problem that involves a petroleum product. Why not find out if Gulf can be of service to *you?* Your Gulf representative is as near as your telephone.

GULF OIL CORPORATION
GULF REFINING COMPANY
1822 Gulf Building
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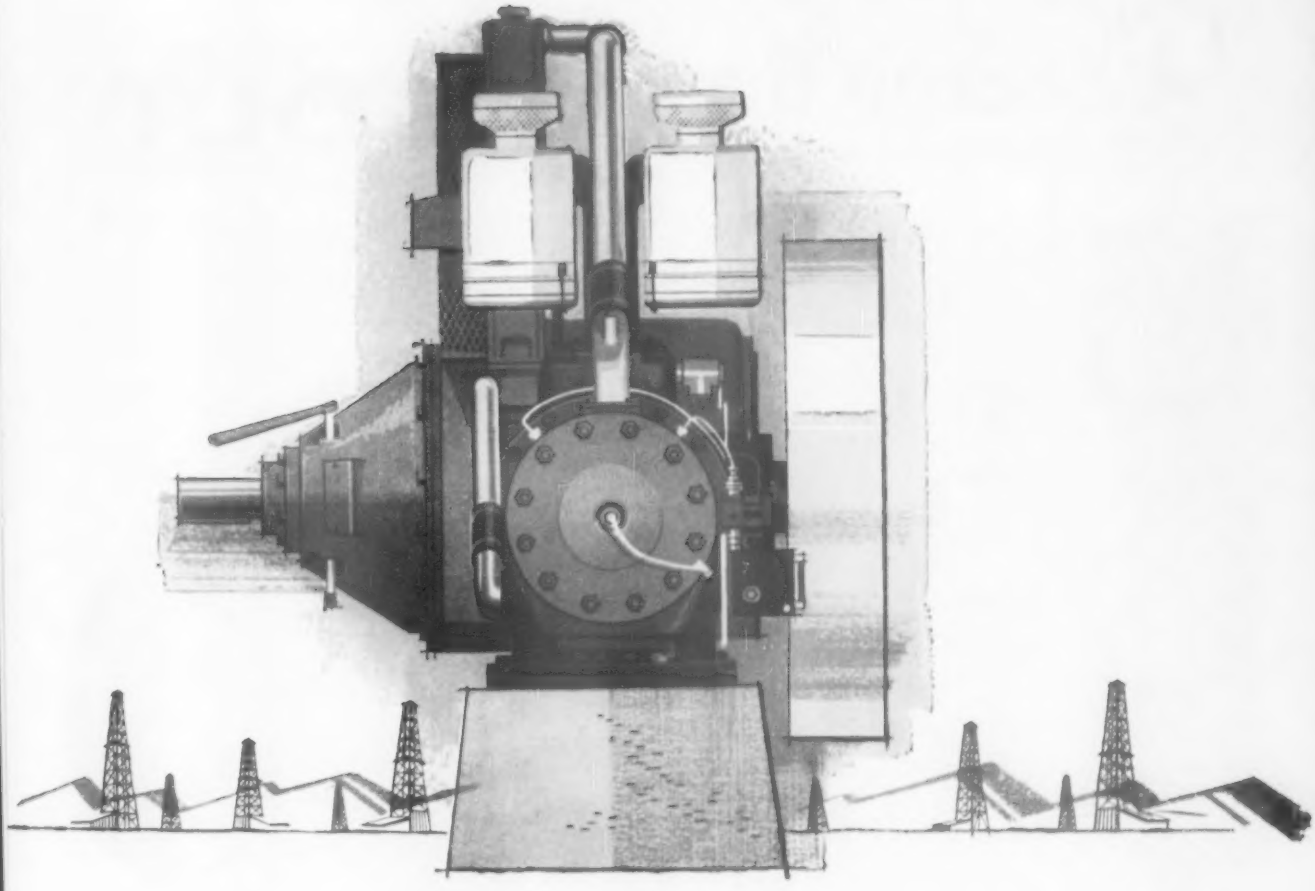
THE FINEST PETROLEUM PRODUCTS FOR ALL YOUR NEEDS



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OIL INDUSTRY OF TODAY!

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This has been true decade after decade,
with Ajax research and manufacture always
in touch with field requirements . . .
always producing prime movers and pumps a
broad step ahead of accelerating performance
demands. Today, with the industry's
standards at their highest, Ajax' response
is at its greatest. *Let your Supply Man
give you the reasons.*

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INDUSTRIAL STEAM ENGINES

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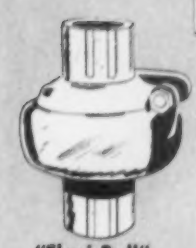
Malleable Couplings

Gas Line Blowdowns



"Flexi-Ball" Joints

"Big Inch" Couplings

Forged Steel Couplings

Scraper Trap Couplings

Adjustable Wing Valves

Tees

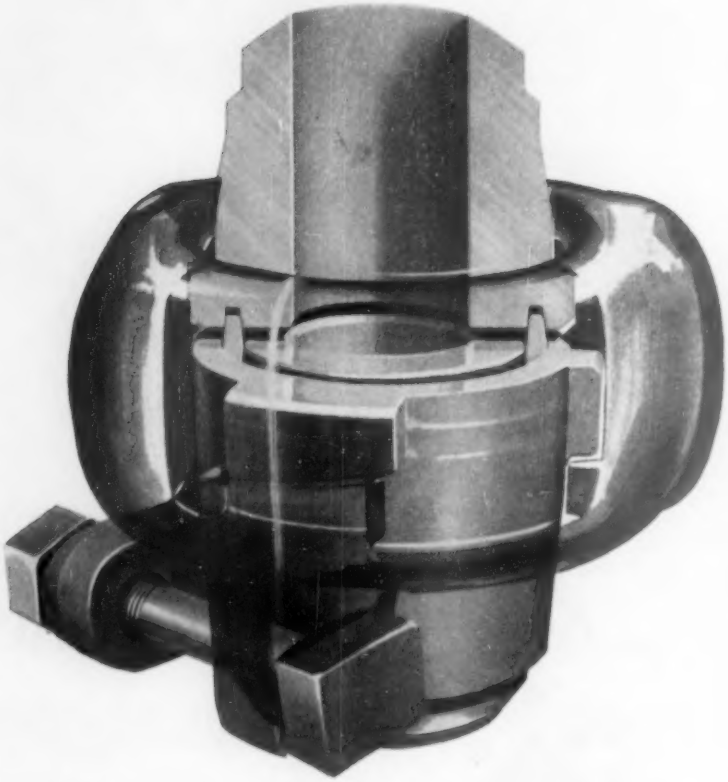
Christmas Tree Flow Manifolds

Crosses

Positive Choke Bodies

UNIBOLT

–lightest–strongest and busiest coupling in the oil world



Lightest because its design rules out bulk, such as flanges, multiple bolts and nuts, hammering lugs, etc. It effectively uses every ounce of steel. The result: minimum weight, maximum compactness for lower cost handling and ease of installation.

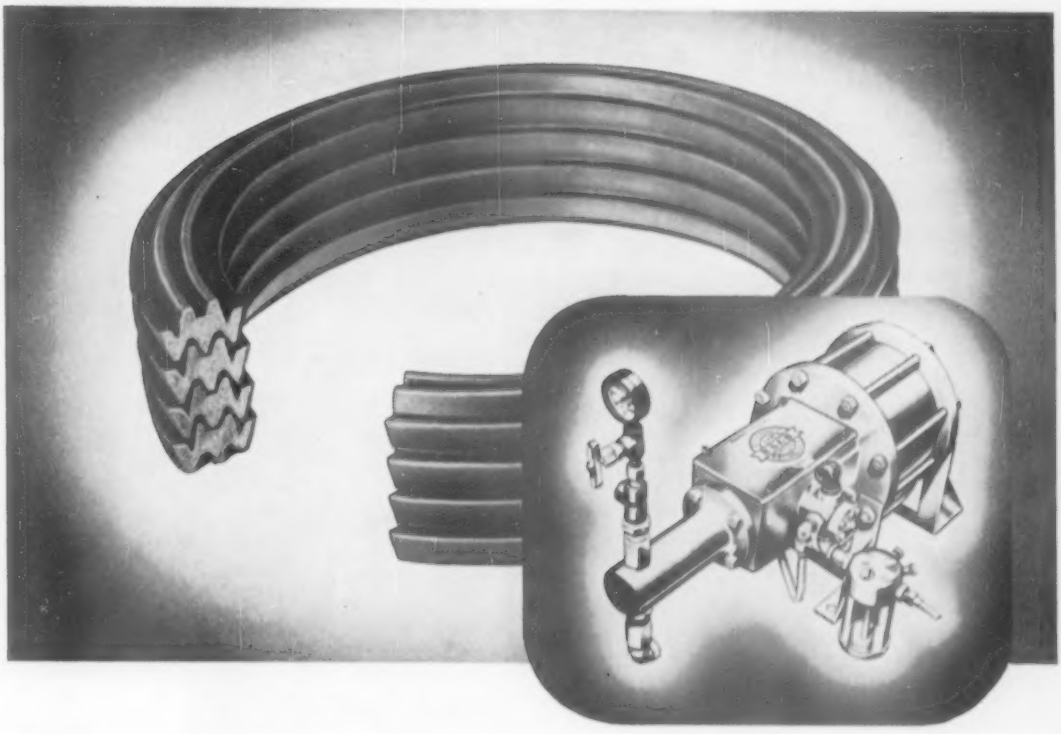
Strongest because, size for size, the UNIBOLT design places more metal in shear.

Busiest because it has replaced flanges and threaded connections on all sorts of Christmas tree fittings, rotary hose connections, and pipeline equipment.

The cutaway view presented here graphically illustrates how the mating tapered shelves on the lug hub and nut member are drawn together in a wedging action by a single bolt (two bolts on large sizes). Thus, by means of leverage, tremendous pressure is applied to seats and seal ring, the latter being available in steel, gasket material, or self-sealing rubber, depending on service conditions. The bolt is under initial stress only. Hubs may be threaded or provisioned for welding.

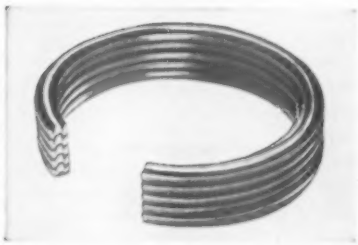
THORNHILL CRAVER CO.
P. O. BOX 1184 HOUSTON, TEXAS.

J-M Uneepac® does it again!



"Very satisfactory sealing service against wide variety of fluids and pressures up to 5,500 psi"

says Black, Sivalls and Bryson, Inc. makers of BS&B Glycol Pump



Uneepac comes in two types. Shown here is design for flange widths up to ½" which is used in BS&B Glycol Pump. Large illustration above shows design for flange widths over ½".

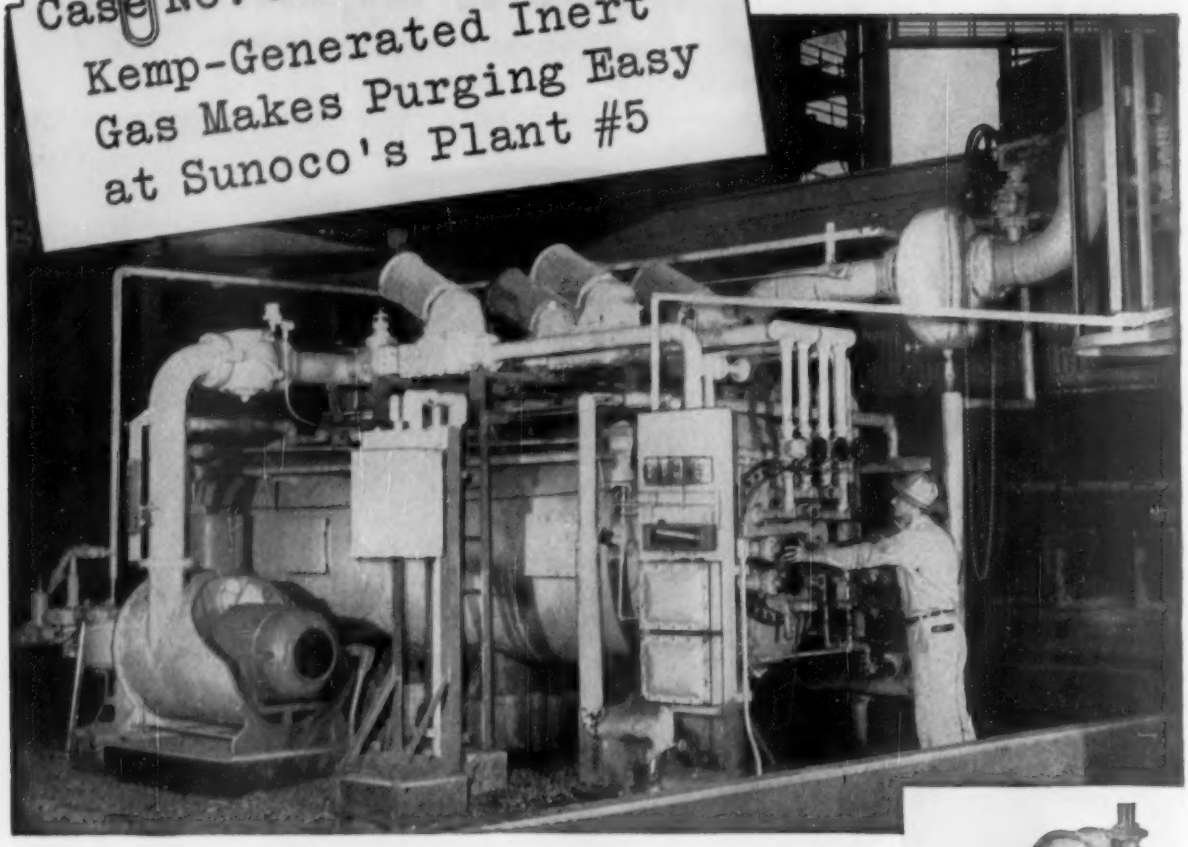
Chalk up another success story for Uneepac—Johns-Manville's automatic ring packing. In the BS&B Glycol Pump, fluids handled include triethylene glycol, diethylene glycol, gasoline, and various types of oils, alcohols and petroleum treating chemicals. Working pressures range from 125 psi to 5,500 psi with average operating pressures at 3,000 psi. Yet despite these rugged service conditions, Uneepac has delivered—in Black, Sivalls and Bryson's own words—"very satisfactory service."

Many other packing users have acclaimed J-M Uneepac for its long, trouble-free service. Each ring is a complete packing unit. Fewer rings are needed than ordinarily required and stuffing box size can be reduced to the minimum. Each ring centers itself automatically on the preceding ring to simplify installation. This exclusive design also permits fluid pressure to act upon each lip individually and protects lips from excessive gland pressure.

J-M Uneepac comes in a wide range of styles and sizes for many rod and plunger applications. For further information write Johns-Manville, Box 14, New York 16, N. Y. In Canada, Port Credit, Ontario.

Johns-Manville PACKINGS, GASKETS and TEXTILES

Case No. 57
Kemp-Generated Inert Gas Makes Purging Easy at Sunoco's Plant #5



How Sun Oil's "Magic Mill" at Toledo operates with 'round the clock safety

There's no *one* word that strikes terror in the hearts of oilmen everywhere more quickly than F-I-R-E! To combat this threat at the Sun Oil Co.'s giant refinery at Toledo, Ohio, constant vigilance, checks and inspections are the answer. And the liberal use of inert gas for purging pipelines, tanks and crackers is essential to this safety maintenance.

Kemp selected to do the job

When plans called for *doubling* plant production in 1950, a new Kemp Generator (see above) was installed to insure adequate inert gas production. Fast-starting, easy-to-operate, this Kemp unit more than filled the bill. Today tanks and lines are periodically purged for inspection and cleaning *as often as needed*. And thanks to its 60,000 cu. ft. per hr. Kemp Inert Gas Generator, Sunoco enjoys *exact analysis* inert production that meets all its purging requirements.

Let Kemp help you, too

If you have a purging or blanketing problem, why not let Kemp Engineers give you the same helpful advice used so profitably at Sun Oil's Toledo refinery. It costs you nothing to investigate. And it may save you money. Find out how Kemp's wide range of dependable, low-cost Generators (complete with the latest fire checks and safety devices) offer you the best way to solve your problems.

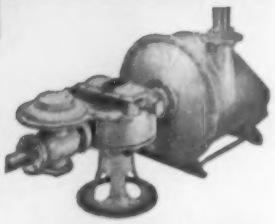
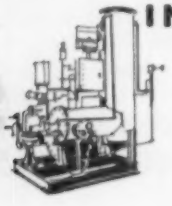


Photo above shows close-up view of Kemp Industrial Carburetor, the heart of every Kemp installation. Assures complete combustion... without waste, without tinkering. Reduces installation costs, simplifies maintenance.

For more complete facts and technical information, write for Bulletin I-10 to **C. M. KEMP MFG. CO., 405 E. Oliver Street, Baltimore 2, Maryland.**

KEMP OF BALTIMORE



INERT GAS GENERATORS

CARBURETORS • BURNERS • FIRE CHECKS
METAL MELTING UNITS • ADSORPTIVE DRYERS • SINGEING EQUIPMENT

They Say—

Turkey's Refining Rules

Dear Sir:

I have just received in the mail a tear sheet from the October 29 issue of The Oil and Gas Journal, page 81. This article appeared while I was in Turkey and I presume it was for that reason that I missed it.

The question was raised by someone interested in undertaking refining activities in Turkey who questioned the statement that the petroleum law at present applies only to exploration and producing activities. My reply was that since the law was passed on March 16, 1954, it has applied to refining operations and pipeline operations within Turkey and there are no amendments to the law either that have been passed or that are in contemplation about which I have any knowledge.

Since a responsible and authoritative journal has indicated a different view I thought it only fair to convey to you the thoughts which I have on the subject and to refer you to the specific provisions of the law in connection with those thoughts.

Article 3(8)(a) of the law defines petroleum operation specifically to include refining. Article 5(a) of the law says that no petroleum operation . . . may be conducted except under a permit, license, lease, or certificate granted under the law. Article 37(1) says that a refinery cannot be the subject of any operation or transaction apart from a certificate.

My conclusion that refining is and has always been covered by the petroleum law of Turkey since its inception on March 16, 1954, seems to be warranted. Accordingly, it would also seem to follow that the major companies have the same problems as every other operator—that is, obtaining a certificate under the petroleum law; and I can assure you that the amendments under consideration with respect to the petroleum law have not been developed because the law "at present applies only to exploration and producing activities."

Elmer E. Batzell
Law Offices
Meyers & Batzell
Washington, D.C.

Petrochemical Potential

"Gas and oil are dominating the chemical picture because of competitive costs. I think it is realistic to assume that gas and oil will continue to

how to
CUT CORROSION LOSSES
a report by Koppers Company, Inc.

James Beaumont
Project Leader

How thick should a protective coating on above ground installations be? This is a question that is asked of our Technical Department quite often.

* * *

All other factors being equal, the thicker the protective coating, the longer its service life. Basically, the coating thickness required is dictated by the degree of protection desired and the conditions under which the coating system must perform. Specifically, you need to know the following things about each job: (1) What is the corrosive environment . . . mild? . . . severe? . . . acid? . . . saline? (2) How long must the coating last? . . . is it practical to re-coat every year or are thicker, longer-lasting coatings desirable? (3) The roughness of the surface: since valley-to-peak distance may be as great as 8 to 10 mils, it is vital that peaks be fully covered to the specified thickness. (4) Finally, you should figure the cost of "down time" in terms of lost production.

Another factor in determining coating thickness is the accessibility of the structure. Our pre-coating surveys always include a careful analysis of inaccessible areas where a thicker coating is recommended simply to eliminate for as long as possible the need to re-coat the hard-to-get-at places. This reduces yearly costs by lessening chances of corrosion in places that are passed-by in routine inspections or that are inaccessible.

* * *

The "Steel Structures Painting Manual" (Vol. 1) points out that average industrial conditions warrant a 5-mil coating and severe corrosive conditions need a coating that *must* exceed 10 mils. Generally, our applications research corroborates these recommendations.

It should be remembered that the inherent characteristics of coating materials determine the maximum thickness to which they may be applied in a single coat. For example, some cold-applied coatings of coal-tar base give, in a single coat, a film up to eight times the thickness of ordinary paints. Coal-tar enamels, widely used for pipeline applications, can be applied much more heavily, normal thickness being between 60 and 100 mils. Of course these heavier single-coat thicknesses mean reduced application time and labor costs as well as longer life.

* * *

Every attempt should be made to "police" the application to make sure that the desired thickness is obtained. Checks on wet or dry film thickness can be made with mechanical, electrical or magnetic gauges designed for the purpose.

* * *

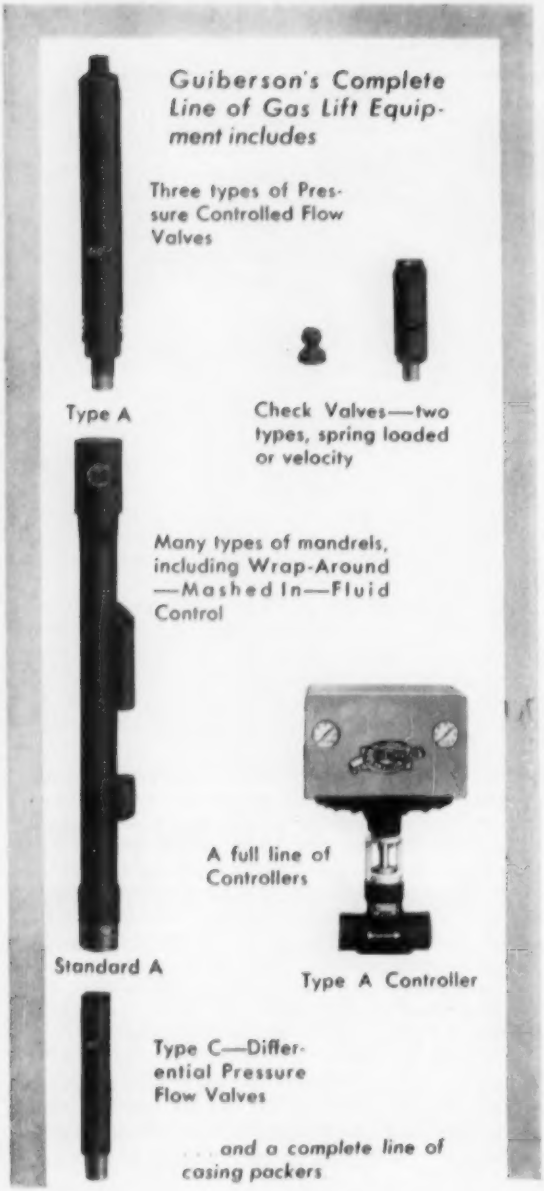
If you have specific problems on protective coating thickness . . . or any corrosion-control problems . . . we'd be glad to hear from you. Write to Koppers Company, Inc., Dept. 104M, 1301 Koppers Building, Pittsburgh, Pa. District Offices: Boston, Chicago, Los Angeles, New York, Pittsburgh and Woodward, Ala. In Canada: Koppers Products, Ltd., Toronto, Ontario and Edmonton, Alberta.

KOPPERS

BITUMASTIC
REG. U. S. PAT. OFF.
COATINGS AND ENAMELS

watch lift COSTS GO DOWN

with GUIBERSON GAS LIFT EQUIPMENT


Guiberson's Complete Line of Gas Lift Equipment includes
Three types of Pressure Controlled Flow Valves
Type A
Check Valves—two types, spring loaded or velocity
Many types of mandrels, including Wrap-Around —Mashed In—Fluid Control
A full line of Controllers
Standard A
Type A Controller
Type C—Differential Pressure Flow Valves
. . . and a complete line of casing packers

When wells won't flow, operators in many fields are meeting rising oil production costs with gas lift. And more and more engineers and field men are finding that Guiberson equipment plus Guiberson experience is the way to the lowest gas lift cost with the greatest economy in initial installation.

Guiberson's line of equipment is complete, designed to solve almost every type of gas lift problem. Guiberson experience, derived from thousands of satisfactory installations, is your assurance that your well will give maximum production for a maximum length of time. No matter what your gas lift problem—intermitting or continuous flow; using lease gas or recycled gas, from single or dual producing zones—look to Guiberson for the equipment and experience that will cut your gas lift costs.

Write us for a recommended gas lift installation for your well.

Guiberson Gas Lift Equipment is protected by the following patents:
2,194,609 2,227,122 2,292,760 2,347,620 2,377,961
2,198,606 2,230,107 2,305,350 2,358,944 2,411,319
2,198,060 2,271,030 2,340,020 2,361,718 2,519,242
Other patents pending.

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Sold by Oil Field Supply Stores Everywhere

THREADS LAST LONGER
with
Jimmie Gray
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IMPROVED
LOOK for RED ARROWS
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to meet the demands of faster, deeper, drilling
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dominate only so long as they are more economical than alternative hydrocarbon sources.

"If oil and gas prices climb too high to be competitive, it is typical of the chemical industry to investigate and to develop competing sources of supply. There is an enormous growth potential for chemicals coming from petroleum and gas. How well this potential is realized depends very much on the competitive situation."

Carl A. Gerstacker, vice president and treasurer, Dow Chemical Co., in a speech before the Independent Petroleum Association of America.

Consumer Looks at Escalation

"Criticism has been made that escalation clauses can only operate to increase prices and never to lower prices and that they result in payment of the highest market price rather than the average.

"It is easy to see how the consumer would look with disfavor on these provisions even though he agreed that the reasonable current market price at the time of delivery should be paid to the producer. He is bound to feel that the highest prices represent something more than the current market price.

"In a steadily rising market, however, it is the highest prices that represent the latest transactions and most nearly reflect the current market. Both the buyers and sellers have generally felt that prices at which the contracts started were so low that there was no prospect of a decline in the general market over the life of the contract."

Richard J. Gonzalez, director and treasurer, Humble Oil & Refining Co., in a speech before the Southwestern Social Science Association, San Antonio.

Surplus and Sinking Prices

"The argument that a price raise is needed because we pay more for our steel and other materials, that we pay more money to our employes, that we drill deeper and deeper to find less and less doesn't help us when we come up against the old law of supply and demand.

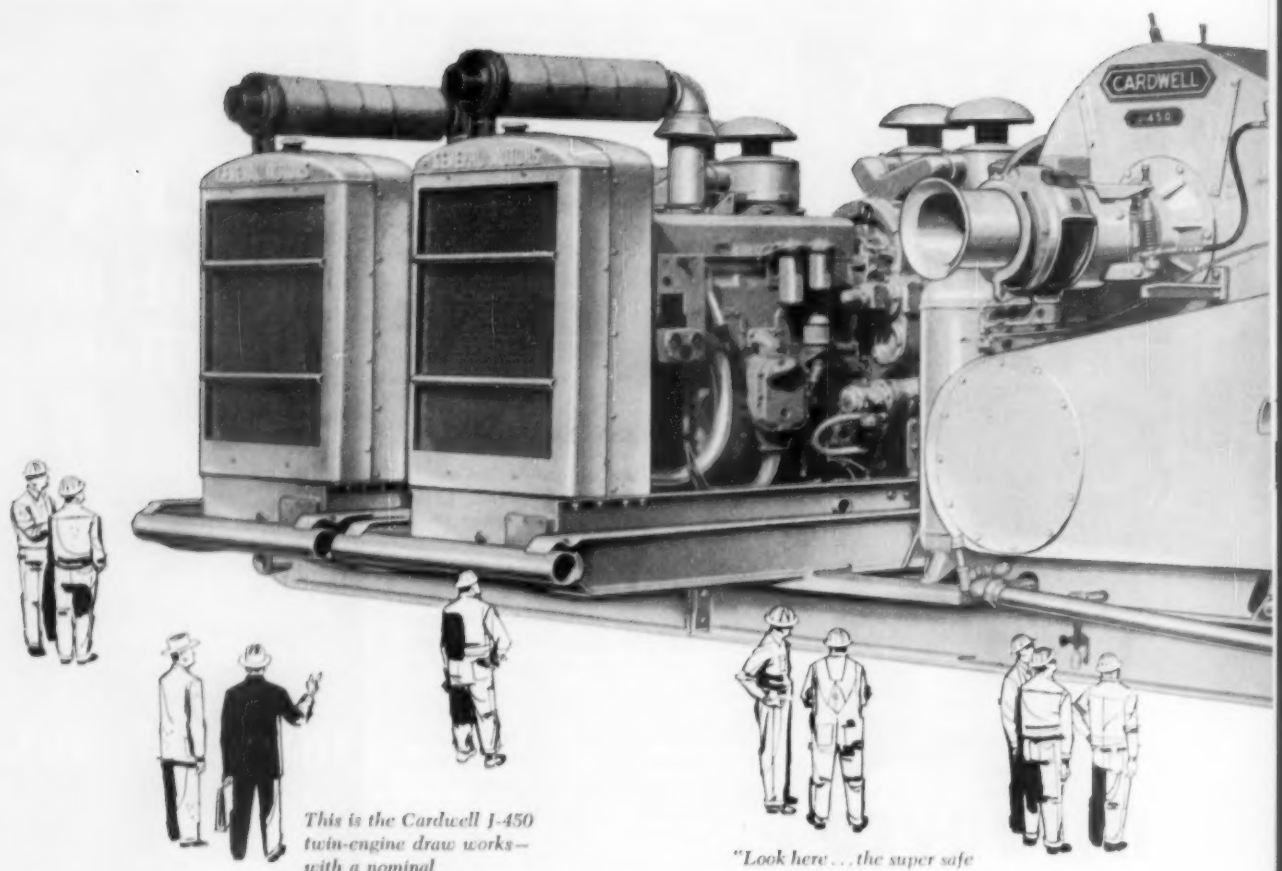
"You don't give your bookkeeper a raise just because he's bought a new car and needs more money to pay his monthly installments, or if you did, then all of your employes would do likewise, and you'd end up broke.

"No, let's face it, oversupply in any commodity results in a tendency toward lower prices. Even as powerful a political bloc as that of the farmer has seen that our agricultural department,

Your fuels and lubricants will meet exacting operational standards when you specify
ENJAY
PETROLEUM ADDITIVES
(PARAMINS®)

including
ENJAY PARANOX
detergent-inhibitor additives

and
ENJAY PARATONE
viscosity index improver
ENJAY
Your only source for a complete line of diversified, high quality petroleum additives (Paramins®).
ENJAY COMPANY, INC.
15 W. 51st St., New York 19, N. Y.
Other offices: Akron • Boston • Chicago • Tulsa
Pioneer in Petrochemicals

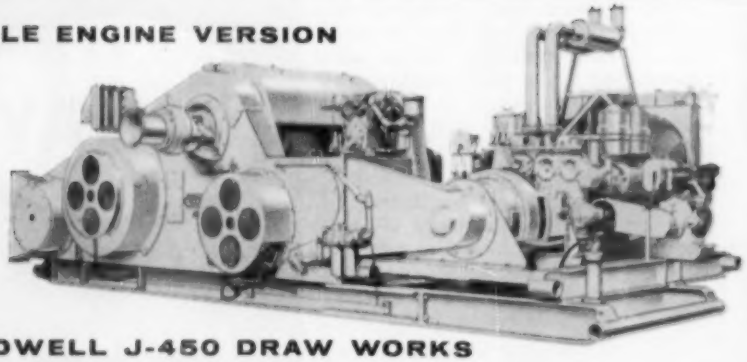


This is the Cardwell J-450 twin-engine draw works—with a nominal 520 input horsepower.

"Look here . . . the super safe cathead shaft permits slow speeds without idling engines or shifting gears."

..."the BIGGEST value in

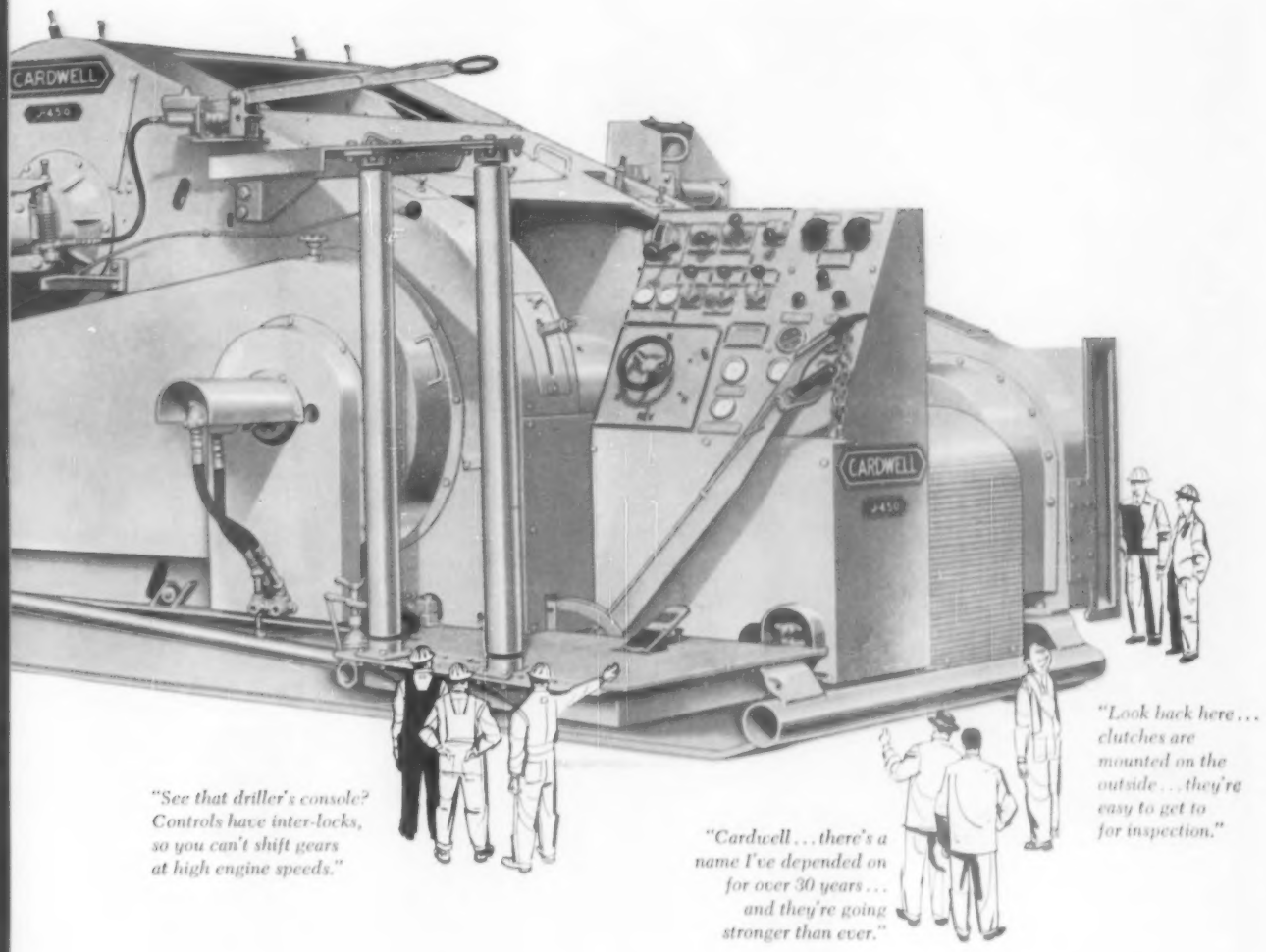
SINGLE ENGINE VERSION



CARDWELL J-450 DRAW WORKS

Single Engine Features

- Torque Converter Driven.
- Air Friction Clutch Drive for Main Drum and Cathead Shaft.
- Serves as split rig, if desired.
- Hoist portion identical to Twin-Engine Model J-450 and adaptable to same accessories.
- Maximum Input Horsepower 520.



"See that driller's console? Controls have inter-locks, so you can't shift gears at high engine speeds."

"Cardwell . . . there's a name I've depended on for over 30 years . . . and they're going stronger than ever."

"Look back here . . . clutches are mounted on the outside . . . they're easy to get to for inspection."

DRILLING RIGS today!"

It's a tool pusher's dream . . . and an owner's delight! Your men will like Cardwell's J-450 because of its fast, efficient operation. You will like it because it reduces drilling costs! The advanced engineering in Cardwell's J-450 twin-engine draw works provides you with maximum flexibility and maximum adaptability to barge, trailer, or skid operation.

– And, Cardwell's rigidly exact quality control – the result of more than 30 years' experience – protects your investment, and reduces costly downtime – for years to come. We invite you to "call on Cardwell."

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United Supply has put SERVICE on the map in the five states where United stores are serving oil field needs around the clock. When you need real service, be sure to call United Supply.

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COURTESY • SERVICE • DEPENDABILITY

backed by seemingly limitless resources of the United States Treasury, cannot hold farm prices up in the face of growing surpluses.

"I haven't any consolation to give out on our short range picture. For it to improve, our rate of domestic production must be cut and at the same time, the mounting flow of imports must be reduced. So bad is our present situation that in many areas the recent federal gasoline tax raise of 1 cent a gallon is being absorbed by industry instead of the general public, and by the industry, that means all of us."

Jake L. Hamon, chairman of the board, American Petroleum Institute, in a speech before the Independent Petroleum Association of America, annual membership meeting, Dallas.

Research: The Big Payoff

"Since petrochemicals serve almost all industries, a great impetus to petrochemical growth results from the research efforts of other industrial enterprises. In our own company we have studied the fruits of research and have arrived at the conclusion that for every dollar spent for research, development, and all other experimental costs, new sales of at least $5.60 result after 5 years.

"At this point the sales curve of these products is just emerging from the sales-development period and is climbing at such a rate that by the end of 10 years the ratio has more than doubled.

"The real 'pay-off' occurs because the earnings from these products are cumulative and continue to increase with time. We should bear in mind that research expenditures have increased sharply in the last 5 years and we cannot tell yet whether the same ratios hold. However, we see no reason why they should not."

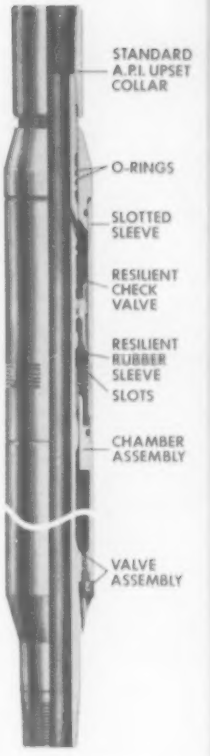
John A. Field, vice president, Union Carbide & Carbon Corp., in a speech before the New York Society of Security Analysts.

Place of the Large Corporation

". . . Profit is not really a dirty word . . . Bigness in industrial enterprise is not of necessity the eighth capital sin. There are jobs so big that they can be handled only by a big corporation.

"Such a corporation, in fact, is no more than a convenient device to permit a great number of small investors to band together in order effectively to handle a big job."

R. O. Taylor, Standard Oil Co. (Ind.), in a speech to the National Management Association in Kansas City.



The operating principle of the Type C Otis Gas Lift Valve is so completely different from conventional gas lift equipment that it makes available certain production practices that heretofore have not been possible for wells on gas lift.

Remarkably simple in design and construction, Type C valves can be used for continuous or intermittent flow, they can be used in dual completions, they are adaptable to permanently-completed wells, they can be adapted for casing flow, and certain sizes can be installed without pulling tubing.

A resilient rubber sleeve is the only moving part, and extremely small opening and closing differentials are possible, even with sand-laden fluids. The valve is built *around* a full-opening mandrel (rather than alongside the tubing) which affords greater strength than the tubing itself. The check seals positively and does not require velocity to close. When used in an intermittent operation, a minimum amount of gas is required to lift the load of fluid, regardless of surface choke settings or long flow lines.

The Type C Otis Gas Lift Valve has so many significant advantages that we believe it has advanced gas lift technology by at least ten years. Ask an Otis man why.

OTIS

OTIS PRESSURE CONTROL, INC.

Gas Lift Division: 2402 Broad Street, Houston

Branches Throughout the Oil Country

"So I says, 'If it's a Christmas Tree... I'll decorate it...'"

The naive young man may not know a Christmas tree from a Christmas tree . . . but here's something you can bet on: veteran Joe Roughneck, symbolic figure of the fabulous oil industry, knows everything about everything concerned with drilling for and producing oil . . . including pipe.

Whether Joe is rendering rugged service on a rig . . or whether he's the brain of a big company . . he knows the kind of quality pipe it takes. More, he knows Lone Star makes it . . and will deliver it on the double! Depend on Lone Star API casing, tubing, and line pipe.

Neighbor, wherever you are,
MERRY CHRISTMAS!

Lone Star STEEL COMPANY

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CALENDAR OF EVENTS

1957

JANUARY

14-16 Pipe Line Contractors Association, ninth annual convention, Boca Raton Hotel and Club, Boca Raton, Fla.

14-18 Society of Automotive Engineers, annual meeting, Sheraton-Cadillac and Statler hotels, Detroit.

21-25 American Institute of Electrical Engineers, 1957 winter general meeting, Hotel Statler, New York City.

23-24 Northwest Petroleum Association, Nicollet Hotel, Minneapolis.

23-25 Instrumentation for the Process Industries, sponsored by Texas A. & M. College, chemical engineering department, College Station, Tex.

31-Feb. 1 Annual instrument short course of Southern California Meter Association, Los Angeles Harbor Junior College, Wilmington, Calif.

FEBRUARY

7-8 Western Petroleum Refiners Association, Gulf Coast regional technical-industrial relations meeting, Lamar Hotel, Houston.

8-9 American Society for Testing Materials, Symposium on composition of petroleum, Jung Hotel, New Orleans.

13-15 National Association of Corrosion Engineers, Tulsa section, eighth annual short course for pipeliners, Hotel Mayo, Tulsa.

15-16 National Society of Professional Engineers, spring meeting, Hotel Francis Marion, Charleston, S. C.

17-18 Engineers, Joint Council, Statler Hotel, New York.

22 Natural Gasoline Association of America, Permian basin regional meeting, Scharbauer Hotel, Midland, Tex.

24-28 American Institute of Mining, Metallurgical and Petroleum Engineers, annual meeting, Hotels Roosevelt and Jung, New Orleans.

MARCH

3-6 American Institute of Chemical Engineers, regional meeting, the Greenbrier, White Sulphur Springs, W. Va.

6-8 American Petroleum Institute, Southwestern district production division meeting, Statler-Hilton Hotel, Dallas.

8 Ohio Oil and Gas Association, winter meeting, Deshler-Hilton Hotel, Columbus, Ohio.

11-15 American Institute of Chemical Engineers, regional meeting, Philadelphia.

11-15 National Association of Corrosion Engineers, Kiel Auditorium, St. Louis.

12-13 Subsurface Geology Symposium, fifth annual conference, sponsored by the University of Oklahoma, Norman, Okla.

20-22 American Petroleum Institute, southern district production division meeting, Washington-Youree and Captain Shreve Hotels, Shreveport, La.

25-27 Western Petroleum Refiners Association, annual meeting, Hilton Plaza Hotel, San Antonio, Tex.

27-29 American Power Conference, Sherman Hotel, Chicago.

APRIL

1-4 American Association of Petroleum Geologists, national convention, Kiel Auditorium, St. Louis.

Hydraulic control panel, located immediately to right of driver's seat, permits pinpoint accuracy in controlling the wire line reel.

Denison TMC pump, operating on a power take-off from the truck transmission, powers two Denison hydraulic motors which operate the reel.

Interior of Camco wire line service truck illustrating wire line reel powered by Denison hydraulic equipment.

Camco Makes Jarring News

...hydraulically-powered service unit affords infinitely variable line speed

WITH THEIR truck-mounted, hydraulically-powered wire line unit, Camco, Inc., of Houston, Texas, has developed a means to speed and simplify oil well servicing.

Designed for removing production tools from a permanent-type well, it is easily adapted to perform surveys which determine a well's characteristics.

A Denison hydraulic pump, and two Denison hydraulic motors operate the 15,000 foot wire line reel. Seated at the control panel, the operator has infinitely variable line speed and can brake hydraulically going in or out of the hole.

The hydraulic control system makes it possible to reverse motors instantaneously while running at top speed, and permits "jar down" with a degree of controlled severity never before possible.

Hydraulic power is transmitted and applied without gears, transmission or other mechanical equipment, permitting accurate control. Better operation, savings in weight, and virtual elimination of maintenance are the benefits.

Let a Denison engineer show you how hydraulic power can improve your oil-field operations. Write to: Denison Engineering Division, American Brake Shoe Company, 1176 Dublin Road, Columbus 16, Ohio. Branch Offices at: 2501 Bartlett St., Houston 6, Texas, 4714 E. 22 Place, Tulsa, Oklahoma.

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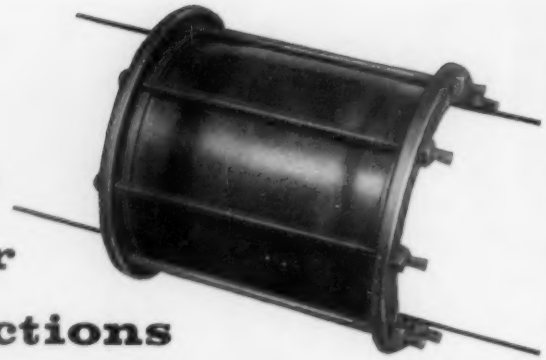
DENISON HydrOILics



for safer connections

join pipe

THE DRESSER WAY!

You'll find many piping jobs in and around oil terminals and refineries that can be simplified and speeded up with Dresser Couplings and Long Sleeves.

Particularly advantageous for tank and equipment installations, Dresser Couplings have a special "built-in" give and take that absorbs vibration, settlement and other stresses.

Perfect alignment of piping is unnecessary because a specially compounded rubber gasket permits up to 4° deflection at joints while guaranteeing bottle-tight connections.

Only a wrench is needed to make the connection. Threading is not required. Any workman can install Dresser Couplings, averaging two man-minutes per bolt.

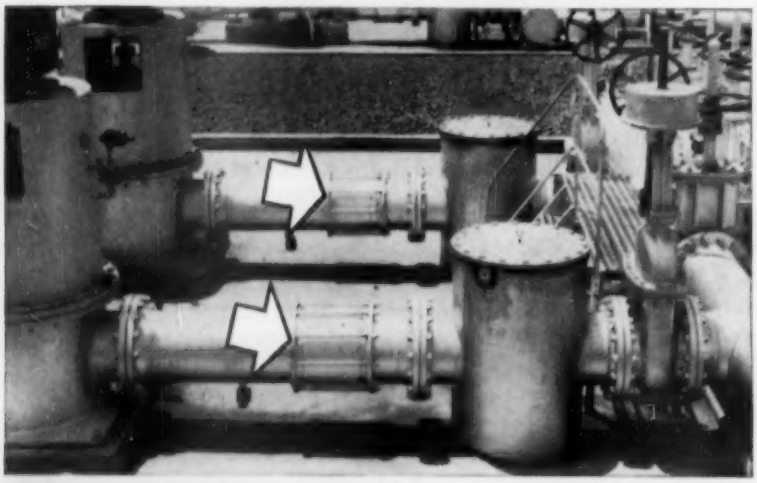
AVAILABLE AT ALL LEADING OILFIELD SUPPLY STORES IN THE UNITED STATES AND CANADA

DRESSER®

Dresser Manufacturing Division • Bradford, Pa.

ONE OF THE DRESSER INDUSTRIES

Dresser 10" Style 40 Long Sleeves on pump at oil terminal



Style 38 Coupling

Style 40 Long Sleeve

Hydrepair® Asbestos Cement Pipe Clamp

Style 63 Expansion Joint

Style 39 Insulating Coupling

2-4 Corrosion Control, fourth annual conference, sponsored by National Association of Corrosion Engineers and the University of Oklahoma College of Engineering, University of Oklahoma, Norman, Okla.

7-10 Petroleum Equipment Suppliers Association, annual convention, Palm Springs, Calif.

7-12 American Chemical Society, national meeting, Miami, Fla.

8-10 American Society of Mechanical Engineers, spring meeting, Dinkler-Tutwiler Hotel, Birmingham, Ala.

10-12 American Petroleum Institute, Mid-Continent district production division meeting, Mayo Hotel, Tulsa.

11-13 American Institute of Mining, Metallurgical, and Petroleum Engineers, Pacific Northwest Regional Conference, Portland, Ore.

14-17 Texas Independent Producers and Royalty Owners Association, Galves and Buccaneer Hotel, Galveston, Tex.

16-18 Southwestern Gas Measurement Short Course, University of Oklahoma, Norman, Okla.

16-18 National Petroleum Association, fifty-fourth semiannual meeting, Cleveland.

24-26 National Gasoline Association of America, thirty-sixth annual convention, Rice Hotel, Houston.

24-26 American Petroleum Institute, Rocky Mountain district production division meeting, Gladstone, Townsend, and Henning Hotels, Casper, Wyo.

28-30 Independent Petroleum Association of America, midyear meeting. Buena Vista Hotel, Biloxi, Miss.

29-30 Automatic Control in the Petroleum and Chemical Industries, conference sponsored by the University of Oklahoma, extension study center, University of Oklahoma, Norman, Okla.

29-May 1 Southern Gas Association, annual convention, New Orleans.

MAY

6-8 American Petroleum Institute, annual pipeline conference, Cleveland Hotel, Cleveland.

6-8 American Geophysical Union, thirty-eighth annual meeting, National Academy of Sciences, Washington, D. C.

7 American Gas Association, committee on underground storage, operating section, Mark Hopkins Hotel, San Francisco.

8-10 American Gas Association, Pacific Coast Gas Association, gas supply, transmission, and storage conference, Mark Hopkins Hotel, San Francisco.

12-15 Liquefied Petroleum Gas Association, annual meeting, Conrad Hilton Hotel, Chicago.

13-16 American Petroleum Institute, division of refining, midyear meeting, Sheraton Hotel, Philadelphia.

19-22 Texas Independent Producers and Royalty Owners Association, Galvez and Buccaneer Hotel, Galveston, Tex.

20-22 American Gas Association, chemical, engineering, and manufactured gas production conference, Balmoral Hotel, Bal Harbour, Fla.

20-23 American Society of Mechanical Engineers, twenty-ninth annual conference and exhibit of the oil and gas power division, Kentucky Hotel, Louisville, Ky.

21-23 Pennsylvania Gas Association, annual meeting, Pocono Manor Inn, Pocono Manor, Pa.

22-24 American Petroleum Institute, division of production, Eastern district meeting, William Penn Hotel, Pittsburgh.

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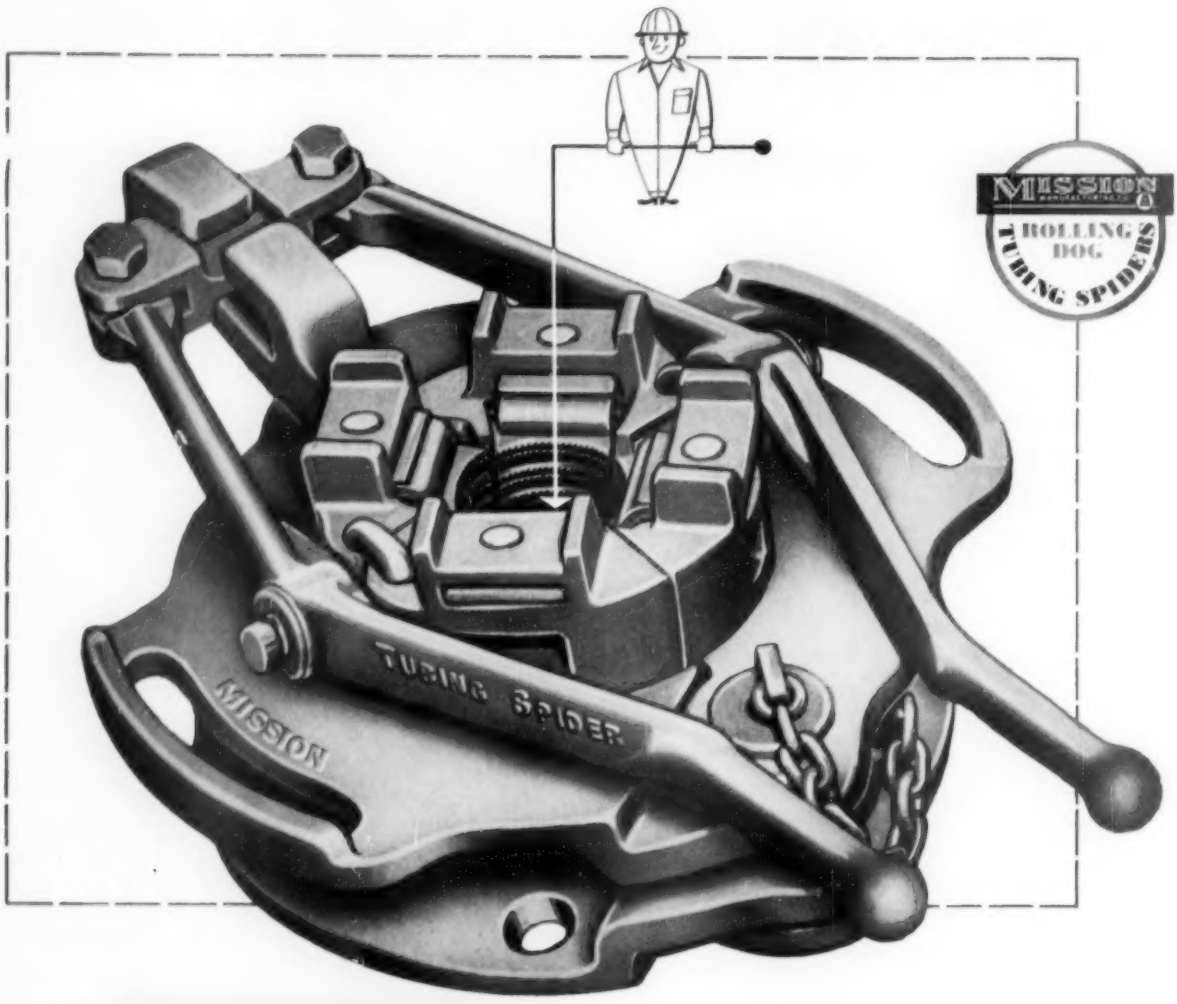

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JOURNALLY SPEAKING . . .

Plane Speaking

COMPLAINING about the oil industry's public relations seems to be a universal pastime these days. Most everybody gripes that the industry gets a lot of unfavorable publicity and that all the advertisements and press releases and other things it puts out aren't doing the job of making friends and influencing politicians.

One reason for this, of course, is that everybody considers himself a real expert on public relations and advertising. And, naturally, no self-respecting expert will agree with another. So there is some divergence of opinion, to put it mildly, as to what sort of program the industry should follow.

We do know that the A.P.I. and the O.I.I.C. are reexamining their program and are in a mood to consider new ideas. Therefore we, as a self-appointed expert, are emboldened to offer our 2 cents' worth.

We think that the industry should adopt an aggressive, positive, direct, outspoken, even pugnacious policy on public relations. Get away from what at times has looked like a timid, apologetic, defensive attitude. Take off the kid gloves and put on the brass knucks. Slug it out, and try for a Sunday punch every time. Adopt the attitude: Okay, so what?

We'll cite just one example. (We cite just one because it's the only one we can think of at the moment.) About all the Chicago newspapers carried on the recent A.P.I. meeting was a story about how the airport there was crowded with "rich oil men's luxurious private planes." This made some people at the meeting cringe and wring their hands and say: "This kind of publicity is bad for the industry. Maybe we ought to stop using airplanes."

Now if we were running the industry's publicity (God forbid), here's what we would have done (hindsight is wonderful, eh?): A few days before the A.P.I. meeting we would have given the Chicago papers a big story warning that the airport would be crowded with private planes operated by oil companies. We would have bragged about how many planes the industry operates, and how many miles they fly, and how much it costs. And we would have explained why—how much money the industry saves by using its own planes, how many jobs these planes do, how the industry couldn't operate efficiently without them.

Get the idea? Take the offensive and make a virtue out of things that oil's critics try to picture as something shameful.

What's wrong about a far-flung company using airplanes to get around in this day and age? It's been whispered to us, behind the backs of hands, that the oil industry has more privately operated planes than any other. And we understand that various companies have figures which prove that, great as the cost is, their company planes save tremendous sums of money.

But the prevailing attitude is that of course no mention should ever be made of an oil-company private airplane because the public might get the wrong impression.

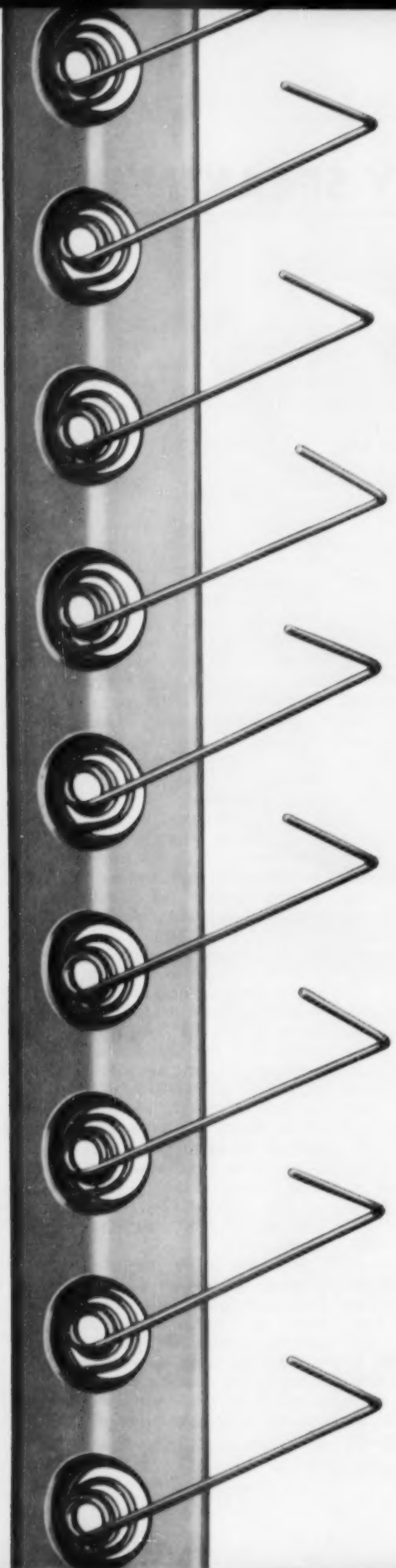
We just don't get it. The public already has the wrong impression. Why not blast out with the truth and sock the detractors right between the eyes?

Sure, some of the executive planes are fixed up pretty plush. They are almost as comfortable for business conferences as the offices of the executives who use them, almost as good as a Pullman club car or drawing room. Okay, so what? When businessmen travel by rail they don't ride the rods; should they fly in bucket seats?

Being an expert on public relations (aren't we all?) we could think of lots and lots of ways in which it looks to us as though the industry missed the boat in failing to get its real message across to the right people, but it seems to us that one of the underlying reasons for this is the inherent fear of oil men that anything they say may be used against them.

We'd like to see the industry boast about its planes instead of trying to hide them. A similar aggressive policy could be followed toward all the industry's publicity. But please don't ask us what we would do with the stories about all the mink coats seen at gatherings of oil men's wives. We haven't got that one figured out yet.

—*Henry D. Ralph.*



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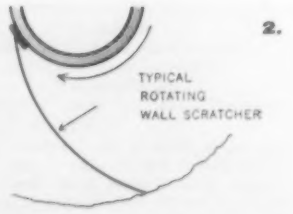

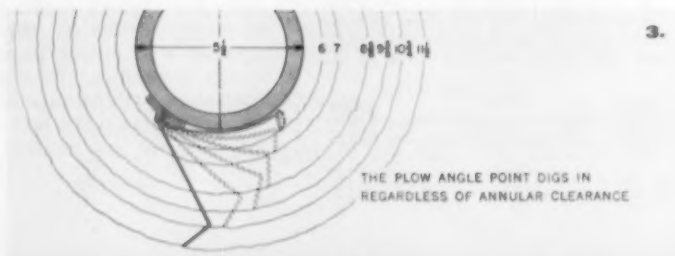

What the emergency program means—and doesn't mean

THERE'S a lot of misunderstanding about the Government's program to get oil to Europe, and it isn't all confined to the general public. Some naive misconceptions exist within the oil industry.

Many oil men are looking to Washington to bail them out of their troubles during this emergency. They will look in vain. The Government's role is chiefly to expedite planning and remove roadblocks to intercompany cooperation and unusual transactions, primarily in tanker scheduling.

Beyond this, the oil industry is as much on its own as ever. Factors of supply and demand, competition, individual business judgment, and ordinary commercial transactions continue as before.

GASOLINE, FOR EXAMPLE. Refiners are besieging Washington to force Europe to buy gasoline it doesn't want, or do something to reduce excess inventories. They get nothing but sympathy.

Refiners will have to solve the gasoline problem themselves. And they had better get busy at it right away, or it will get worse. If refiners try to meet the demand for resid and distillates while continuing to pile up more stocks of unsalable gasoline they will pile up trouble for themselves in full storage tanks and lower prices. And this at a time when crude will cost some of them more.

Price controls aren't part of the program. There is no law on the books authorizing them. Congress could enact such a law, but probably won't unless things get badly out of hand.

Crude prices will react to the laws of supply and demand. If purchasers are short of crude and feel a higher price will make more available they will raise prices. If not, they won't. But a weak gasoline market may no longer be the dominant factor in holding down all crude prices.

Where buyers get their crude, what they pay for it, and how they get it to tanker docks is their business. The Government isn't going to say how much any area should produce, or what the stock levels should be. If some inland area produces more than it can sell and slops over its storage tanks, that's its hard luck.

IN SHORT, it's business as usual with the domestic oil industry—the usual business judgments, risks, and opportunities. The complications growing out of the abnormal demand for some, but not all, crudes, and for some, but not all, products are the individual problems of the particular operators affected.

And who will pay for the program? The consumers, of course—consumers in Europe and the United States to the extent that higher costs are involved and to the extent that suppliers pass on these costs. Any Government aid will be to make up dollar-exchange deficiencies of European governments, not to subsidize consumers, producers, or refiners.

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Current and significant in . . .

The Industry This Week

Drilling

• **Deep drilling in Los Angeles'** residential areas has been given a boost. City Council approved exploratory drilling for old Salt Lake field just a stone's throw from the city's famed swank cafe row. P. 96.

Drilling has resumed in Egypt's western desert. Sahara Petroleum crews went back to at least two wildcats where work stopped at outbreak of Suez hostilities. P. 107.

Good flow from Heath formation gives promise of a new oil pool for western North Dakota. Well is Northern Pump's 1 Fritz in Billings County. P. 97.

Processing

• **Ripple trays** are fast becoming new fractionating tool. They have reputation for high capacity, low cost, and operating flexibility at high-operating loads. P. 91.

Nation's largest coking unit—42,000-bbl. fluid unit at Tidewater's Avon refinery—has gone on stream. P. 92.

Shale oil will start flowing in February from Union Oil's experimental station in Colorado. Last unit needed is a 300-ton pilot retort. P. 94.

Brazil is betting heavily its refinery expansion program will make nation self-sufficient for products by 1960. Bulk of program lies in new refinery at Rio de Janeiro and new units in Sao Paulo area. P. 105.

Baghdad refinery, biggest in Iraq, will be doubled in size in next 30 months. Contractors already are studying bids. P. 105.

Industry

• **Coordinated tanker and pipeline movements** are going into effect to smooth out Western Hemisphere effort to supply oil to Europe. One sore spot: Saboteurs strike in Kuwait fields. P. 88.

Cost of California's conservation battle came high. Final figures show operators spent $5 million. P. 87.

Wage boosts of 27 cents an hour will be sought by O.C.A.W. units in bargaining efforts with the oil industry. P. 85.

New deal on imports will emerge after Middle East crisis is over. Government is expected to insist all imports, except those from Canada, must be kept within 1954 ratio to domestic production. P. 104.

Pipelines

• **Cry of monopoly is being raised** in merger of Pacific Northwest Pipeline Co. and El Paso Natural Gas Co. California officials want federal Government to investigate possibilities of antitrust violations. P. 91.

Florida's chances for major natural-gas pipeline appear brighter. Optimism stems from FPC action clearing way for early decision on applications to build the line from Lower Rio Grande Valley of Texas. P. 90.

Natural Gas

• **Kansas' 11-cent minimum price** for gas at the wellhead has been upheld by the Kansas Supreme Court. But that probably won't settle issue. Cities Service may take fight to U. S. Supreme Court. Big question: Where is dividing line between state and federal authority over natural gas ticketed for interstate commerce? P. 86.

Phillips' natural-gas department has suffered a personnel tragedy. Five of the eight men killed in company plane crash were in this department. P. 98.

It's a matter of putting your money in the right spot at the right time, says F. O. Prior in explaining . . .

Why Indiana Standard Is Going Abroad

Gene T. Kinney

THE nation's largest strictly domestic oil company, having dipped a tentative toe into foreign waters, is acting as if it is ready to plunge in all the way.

Standard Oil Co. (Ind.), in returning to the foreign field on which it turned its back a quarter of a century ago, is active on three fronts:

. . . A Cuban wildcat, its first in a $14,750,000, 7½ year exploration program, has been staked 25 miles north-northeast of Santiago on the southern coast.

. . . Its first Jamaican wildcat has been taken below 6,000 ft. and will be deepened when a heavier rig is available.

. . . Exploration in Venezuela is in progress in several sections of the country where Indiana Standard formerly controlled the most prolific properties in the Western Hemisphere. Information disclosed by extensive seismic work will determine in what areas the company will bid when new concessions are offered.

Other parts of the Western Hemisphere also are under scrutiny. Now that the company has broken its domestic traces, it appears ready to take advantage of any foreign opportunity which may seem favorable.

What is behind this about face in Standard's exploration and production policy?

The key man in this new policy is Frank O. Prior, president of Indiana Standard. His principal job has been to develop a crude supply since 1930 when he became first president of Stanolind Oil & Gas Co., Standard's producing subsidiary.

1. Why not stay home?

To explain these foreign moves, Prior scorns the stock answers about high domestic finding costs, the difficulty of competing against cheap foreign oil, and diminishing domestic prospects. Such broad generalizations do not impress him.

"Finding costs here are up, yes," he says. "But they are not cheap abroad. It's an individual situation, just like in this country. Per-barrel costs are cheaper for some, more expensive for others. You know, you can spend a lot of money abroad and not find any oil."

Prior knows what it is to compete against imports, too, although Standard of Indiana is a minor importer itself (27,000 bbl. per day). Had it not been for proration, it is estimated that the company last year could have increased production 120,000 bbl. above its average of 274,100 bbl. per day and still not exceeded maximum efficient rates. As a refiner and marketer, it is affected by foreign crude and products on the Gulf and East coasts.

Of the difficulty of finding major fields in the U. S., he observes:

"It is getting harder and harder to find real oil." His own company is an excellent example. Its biggest find, the 500,000,000-bbl. Hastings field on the Texas Gulf Coast, was made 22 years ago.

Although Standard has been among the most successful in the industry in exploration—its 2,098,000,000 bbl. of reserves on January 1 ranked second in the U. S.—it has done it the hard way, by finding a lot of fields. Another important factor in its success was the judicious use of the cash from the sale of foreign properties to buy domestic reserves in the 1930's when they were cheap.

But Prior is the last to say that exploration opportunity at home is disappearing.

"They had given up on the interior salt domes in Louisiana and Texas," he points out. But the myth that these domes would never produce was exploded this year by British-American Oil Producing Co.'s Woodbine discovery on the Hainesville dome in East Texas.

Where to spend money . . . Stated simply, the foreign moves are the result of this general policy: You channel the money available for exploration into spots where it can be spent to best advantage.

Where Indiana Standard is busy abroad...
C U B A
1 With block added last week, company gets a cheap look at 16,000,000 acres.
HAITI
DOMINICAN REPUBLIC
JAMAICA
2 If oil is found—and first test had a show—Standard has pick of whole island.
C A R I B B E A N S E A
HONDURAS
NICARAGUA
3 Return to Venezuela is tipoff of major moves in the works.
COSTA RICA
VENEZUELA

When the foreign properties of the affiliated Pan American Petroleum & Transport Co. were sold to Standard Oil Co. (N. J.) in 1932, Standard of Indiana was left without a crude supply.

"We had the immediate job of developing reserves and production for our southern and eastern marketing spread," Prior says. The quickest way to get that supply was to buy producing properties. Eleven major acquisitions were made under Prior, including the Yount-Lee Oil Co. in 1935 for $42 million cash.

Stanolind started an aggressive program on its own in East Texas and the Gulf Coast.

"We were very successful, and developments like Hastings took all our attention. Then we had a run of success in finding production in the West Texas play. You can't be every place at all times. You simply have to take a look and decide where you can spend your money to best advantage. Then, for us, it was in West Texas."

After World War II, the company began to turn its eyes abroad once more. "We looked over Canada, Colombia, Venezuela, quite a lot of places," Prior says.

Concessions were obtained in Colombia. But that venture turned sour and in 1949, a year after entering Colombia, Indiana Standard pulled out awaiting a more favorable operating climate. Canada was another story, however. Production there has passed the 10,000-bbl. daily mark. Standard does not regard this as "foreign" but, like most other U. S. oil companies, considers Canada as a domestic operation.

2. Three favored areas

The next moves were in Cuba and Jamaica, which Prior calls cheap long shots.

Cuba, whose oil history dates back almost a century, is producing only 1,700 bbl. per day. Good source production from any substantial depth continues to elude oil finders. But since the shallow Jatibonico discovery in 1954, the entire island and its tidelands have been leased.

Operating as Cuban Stanolind Oil Co., the company has the biggest program in Cuba. To its original farmout of 12,000,000 acres from Trans Cuba Oil Co. and Cuban Venezuelan Oil Voting Trust, Cuban Stanolind added 3,000,000 acres in Oriente and Camaguey provinces last week. It is earning 50 per cent interest in this block through the exploration program just getting under way and in addition has rights on another million acres nearby.

The wildcat near Santiago, located on the Los Chivos dome, will be but the first of several to evaluate the big acreage spread.

Jamaican Stanolind Oil Co. has exclusive rights to all of Jamaica, involving some 5,500,000 acres in which it has 75 per cent interest. It will spend $2 million there by mid-1958. There is no production on Jamaica, but shows were found in the first wildcat ever drilled on the island in 1955.

"These are long shots, of course," Prior concedes. "We had some new ideas on Cuba and we'll soon find out whether they are good, bad, or indifferent. If they work out, that should make Jamaica interesting, too.

"The thing about these deals is that they afford us a good look at both on a modest expenditure of money for the acreage involved. And we can pull out at any time with the payment of a small penalty."

Next Venezuela . . . Venezuela is another matter entirely.

The ante is bigger—some 25,000-acre Lake Maracaibo tracts recently brought $20,000,000 to $30,000,000—but so are the stakes.

Indiana Standard has organized Venezuelan Pan American Petroleum Corp., borrowing the name from the old Pan American Petroleum & Transport which formerly held its foreign properties.

Two seismograph parties are working in the State of Anzoategui, one in the Gulf of Paria, and another in the State of Monagas.

The company plans to go after concessions in Barinas, where bidding is sure to be steep. Development of a major discovery by Sinclair Oil Corp. and Socony Mobil Oil Co., Inc., plus a pipeline outlet to be completed next year, will make the Barinas-Apure basin the third major producing area in Venezuela.

"We are interested in all sections—the east, Orinoco, the lake, everywhere," Prior says. The company may

How Prior sees the moves . . .

Cuba's a cheap long shot.

Jamaica's a gamble, too.

Costs are high in Venezuela

. . . But so are the stakes

enter into partnership operations as well as explore independently.

Prior isn't ready to divulge Venezuelan plans at this time. "We'll announce it when we have something substantial," he says.

3. Why it happened

Back of Standard's sales of its foreign properties in 1932 was the depression at home and a double-squeeze abroad. It had already sold its one-sixth interest in Near East Development Corp. to Jersey Standard the year before.

Two major factors dictated the sale of producing and refining holdings in Mexico, Venezeula, and Aruba:

. . . **The nationalization** threat in Mexico.

. . . **The impending tariff** on oil products imported into the United States.

Indiana Standard was in the position of having to get into foreign marketing in a big way—meaning an expenditure of millions—or get out of foreign operations altogether. Edward G. Seubert, president of the company from 1927 to 1944, chose to get out.

It looked like a brilliant move. In a matter of a few weeks after the deal was completed on May 6, 1932, Congress imposed a tariff which sharply curtailed fuel-oil imports and shut off gasoline imports entirely. Furthermore, the feared Mexican expropriation came to pass.

Indiana Standard came out of the deal with almost $48 million cash with which to build up crude and products supplies in the U. S. It also got 1,778,973 shares of Jersey Standard stock, worth $90 million, making Indiana Standard the largest stockholder in the largest oil company in the world.

The Jersey stock provided an important source of income over the years and permitted the Indiana company to participate in foreign operations from a sheltered position.

The original number of shares is equal to 11,902,041 shares today with a value of $655,000,000. Indiana Standard holds 4,235,883 shares worth $230,000,000; the difference in shares went to stockholders as dividends.

Jersey, the only company large enough or willing to handle a deal of this size, came out with major refineries in Aruba and Mexico; a 3,000,000-bbl. tanker fleet; 125,000 bbl. daily in production in Venezuela and 26,000 in Mexico (which it lost in the expropriation); and, most important, 3,000,000 acres of producing properties in and around Lake Maracaibo which later helped make Jersey Standard's Creole Petroleum Corp. the world's largest producer at around a million barrels a day.

Rapid growth . . . Indiana Standard didn't seem to suffer any for having disposed of these vast foreign properties during a period when such holdings gave other companies a competitive advantage.

It has grown to be the fifth-largest domestic producer. Moreover, its liquid reserves and refining capacity (655,000 bbl. per day) are second in the U. S. only to its former parent, Jersey Standard, from which it was divorced when the Standard Oil Trust was dissolved 45 years ago.

That the proceeds from the Pan American sales were spent wisely is apparent from the company's phenomenal growth through prudent purchases, its own oil-finding, and an aggressive program of expansion in refining and marketing.

The ideal situation for an integrated company would be a balance between production and refining. Indiana Standard produces only around 45 per cent of its crude requirements, close to the 50 per cent which has been its long-range goal. But rather than lack of success in exploration, this imbalance accents the tremendous progress in refining and marketing.

Perhaps now the pendulum may swing the other way, as evidenced by a statement from Robert E. Wilson, chairman of the board, a year ago:

"Now that our most pressing expansion of refining and transportation facilities is behind us, we are seriously interested in foreign opportunities . . . While a substantial interest in a company like Jersey is a very comfortable way to engage in foreign production, it should not and will not lull us into overlooking real opportunities within our means."

Knight spearheads O.C.A.W. policy meeting where . . .

Big Wage Goal Is Set

DENVER. — Bargaining units of the Oil, Chemical and Atomic Workers International Union are demanding 1957 wage increases of not less than 27 cents an hour for 105,000 members employed in the oil industry.

The wage goal was set by the union's bargaining policy committee, which annually establishes mandatory programs to be followed in negotiating new contracts. The committee is headed by O. A. (Jack) Knight, O.C.A.W. president.

The 27-cent minimum can be applied by a straight wage increase, on an equivalent percentage basis, or in a combination of those forms, the 52-man committee said.

Current wage scales in oil production, pipelining, and refining range from $2.56 to $2.67 an hour. Most of the union's contracts with oil companies are open for wage talks in February and March.

The committee said the increase is justified by many factors, including:

. . . Cost of living increase, which is continuing.

. . . Increase in productivity for the entire national economy.

. . . The oil industry's increase in productivity.

. . . Wage and fringe benefit improvements being won by unions in other industries.

. . . Increase in profits to oil companies.

Last year's increase . . . The O.C.A.W. oil industry workers received their last general increase effective February 1, 1956. It amounted to 6 per cent, with a 15-cent-an-hour minimum, plus boosts in evening shift premiums from 6 to 8 cents an hour and in graveyard shifts from 12 to 16 cents an hour.

However, many O.C.A.W. contracts are firm for 2 or 3 years as they apply to fringe benefits and permit only wage clauses to be reopened annually.

An example is the contract covering 15,000 O.C.A.W. members employed by Sinclair Oil Corp. This agreement, largest held by the union in the industry, expires next June 15, giving the union its first opportunity in 5 years to demand improvements in such items as retirement, vacations, holidays, and hospital and surgical programs.

The O.C.A.W. policy committee said it would prepare immediately a fringe benefits program.

Other unions . . . The approximately 10 per cent hike sought by O.C.A.W. varies only slightly from the goal announced 2 weeks earlier by the year-old Federation of Independent Oil Unions in current negotiations. The federation is requesting not less than a 10 per cent increase with a minimum of 25 cents an hour for its 30,000 oil industry members in various independent unions *(The Oil and Gas Journal, December 3, page 72).*

The Canadian O.C.A.W. is demanding an oil industry wage increase of 12½ per cent in 1957 contracts, plus shift differentials of 15 and 20 cents, double time for all overtime, and premium pay for regular Sunday work for shift workers.

Industry briefs

Blanton Drilling Co., Houston, has been sold to Claude R. Whelchel and D. A. (Slim) Cammack for more than $600,000. Name of the firm is being changed to Admiral Drilling Co.

Whelchel, a former partner in Longhorn Supply Co., will be president of the drilling company. Cammack is vice president and drilling superintendent of Blanton Drilling Co. and will hold the same positions in the new company. The sale involved seven drilling rigs plus various interests in 14 producing wells.

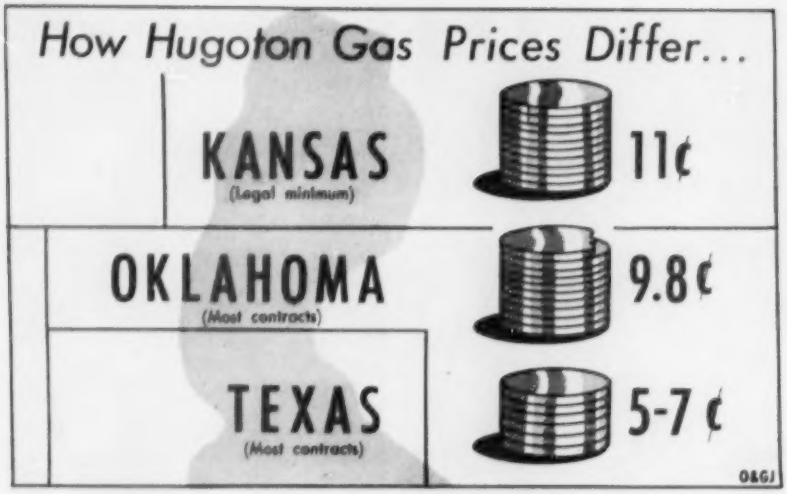
Southwestern Consultants, Inc., Oklahoma City, has acquired interests on 19 leases in central and northern Oklahoma, formerly owned by W. B. Cleary, Inc., also of Oklahoma City. The property includes 27 oil wells and 2 gas wells.

Canada's largest ocean-going tanker —the Imperial St. Lawrence—will unload its first cargo of Venezuelan crude oil in March. The 35,500-ton vessel was built for Imperial Oil, Ltd., by Mitsubishi Shipbuilding & Engineering Co. in Nagasaki, Japan, and was launched earlier this month. With a capacity of 300,000 bbl., the tanker will carry crude to Imperial's Halifax refinery and to Portland, Me., for pipeline delivery to Montreal.

Water flooding will be stepped up on property in Allen and Neosho counties, Kansas, recently acquired by Big Chief Drilling Co. and W. W. Whiteman, Jr., Oklahoma City. Initially, 20 key pilot wells will be drilled to develop the Bartlesville sand at 800 ft. Big Chief and Whiteman bought the 4,400 acres of leases from Joe Aylward of Wichita, and Gordon Willis of Chanute, and associates. Production totals 500 bbl. per day.

Gov. Raymond Gary of Oklahoma was elected chairman of the Interstate Oil Compact Commission for 1957 at the winter meeting in Miami Beach, Fla. He succeeds Gov. John F. Simms of New Mexico. Other new officers are Clarence T. Smith, Flora, Ill., first vice president, and J. P. Jones, Bradford, Pa., second vice president. Meetings for 1957 are scheduled in Yellowstone National Park June 10-12, and Tulsa December 1-3.

The Alabama Department of Conservation will accept bids February 20, 1957, for oil and gas leases on 54,340 acres underlying Upper and Lower Mobile Bay. The acreage will be offered in 13 tracts.



Kansas Prices Upheld

State can fix prices on interstate gas at the wellhead, Kansas rules; issue apparently headed for highest court

TOPEKA, Kans.—Where is the dividing line between state and federal authority over natural gas ticketed for interstate commerce?

The U. S. Supreme Court hit at the fringes of this question last year when it ruled against an Oklahoma law fixing a minimum price on Hugoton field gas. The high court may soon be asked for a more specific answer.

A price-fixing order issued for the Kansas section of Hugoton in 1953 by the Kansas Corporation Commission was upheld last week by the Kansas Supreme Court. Cities Service Gas Co. of Oklahoma City contested the order and probably will appeal it.

First step by Cities Service will be to ask for a rehearing from the Kansas court. The company is not saying whether it will continue the fight if the rehearing is denied, but indications are that it will.

The Kansas commission put its minimum—11 cents per 1,000 cu. ft.—into effect at the start of 1954. But it went about it in a way that was slightly different from the Oklahoma attempt.

In the Oklahoma case, the state commission fixed the price of residue gas at the tail gate of a processing plant. The state Supreme Court upheld the order, but the U. S. Supreme Court upset the decision. The federal court ruled in effect that the gas had already passed into jurisdiction of the Federal Power Commission before the price was set. It said:

"Oklahoma has attempted to fix a minimum price to be paid for natural gas, after its production and gathering has ended, by a company which transports the gas for resale in interstate commerce" *(The Oil and Gas Journal, April 18, 1955, page 104).*

The ruling might not apply in the Kansas case, however, since the Kansas commission fixed its price at the wellhead. Cities Service argued that the gas was for interstate commerce and that the FPC, not the state, has jurisdiction over it. The Kansas commission said the order was issued to prevent waste, placing the gas under its jurisdiction.

It based the price on gas measured at 14.65 psi. Previously, the gas in the Kansas section was measured at 16.4.

Up in the air . . . Actually, the Oklahoma order is only partly settled. The same order which fixed the price of residue gas also fixed the price of gas at the wellhead. It's this last part that is still up in the air.

The U. S. Supreme Court did not rule on that section, but issued a mandate back to the Oklahoma Supreme Court. The decision is still pending. Most gas-company attorneys feel that the court can't validate a part of the order and invalidate the rest of it. So the whole thing will probably be thrown out.

In the meantime, Oklahoma producers are still getting the 9.8262-cent minimum on their gas, although a few new contracts have been negotiated for as much as 15 to 16 cents. In Texas, too, where the bulk of gas production is going for 5 to 7 cents, what few new contracts have been made are giving producers more money.

Peerless case . . . The U. S. Supreme Court previously upheld the right of Kansas to fix gas prices at the wellhead, but the court pointed out that it was ruling only on the constitutionality of the act and not on the question of who has jurisdiction at that point.

The case involved Cities Service Gas Co. and Peerless Oil & Gas Co. The latter, in an attempt to gain higher prices for its gas, won the backing of the state, which issued an order placing a wellhead minimum of 7 cents per 1,000 cu. ft. on gas from Guymon-Hugoton field.

In upholding the order, the court made it clear that "the decision was intended to be narrowly applicable to the particular situation before the court." It said:

"Whether the Gas Act authorizes the Power Commission to set field prices on sales by independent producers or leaves that function to the states is not before this court."

The Kansas case might put the issue there, however, and the question which has bothered gas men ever since FPC moved into the picture appears destined for an answer at last. But if it comes, what then?

The big picture . . . Some purchasers and consumers are afraid runaway prices might result if the order is validated by the U. S. Supreme Court. It could, they say, result in other states issuing similar orders and then entering into competition over prices.

To bolster their argument, they point to what has happened in recent years in Hugoton field. Oklahoma raised the price on its side of the line first. It went to 7 cents per 1,000 cu. ft. Kansas followed with a raise to 8 cents, Oklahoma came back with a hike to 9.82 cents, and Kansas then went to 11 cents.

This price war in reverse, if it developed, could conceivably put a tight pinch on some consumers who might have to pay high prices for their gas and then fail to get FPC approval to pass the boosts along to their customers. They think FPC might balk if the prices went too high.

Some interested parties have other fears, too. Last March, Oliver Brown, president of the Southwest Kansas Royalty Owners Association, charged that the price-fixing order was cutting into their sales.

He pointed out that, with gas selling for 5 to 7 cents on the Texas side of the line and slightly under 10 cents in Oklahoma, the two states were selling considerably more gas than Kansas.

On the other side of the fence, of course, these fears are considered

groundless, and some valid arguments are being raised in favor of state authority.

Rates not issue . . . Cities Service Gas made it plain that its fight is not over rates. As one spokesman put it:

"We are not opposed to a fair price for producers. We want it. We think it is necessary so that exploration for new reserves will continue. And 11 cents per 1,000 cu. ft. might not be out of line. But we want to make sure nobody goes overboard. We want a brake some place. A happy medium. And we still feel the best solution is the law of supply and demand."

Cities Service Gas purchases more than one-third of its entire supply from Kansas Hugoton operators. The company bought 124 billion cubic feet of gas from this source in 1955 for an average of 340 million cubic feet daily.

The company operates some 5,000 miles of main lines with 23 compressor stations, in Texas, Oklahoma, Kansas, Missouri, and Nebraska. It serves over 400 towns and cities, with about 40 per cent of them in Kansas. These include most of the principal cities, such as Kansas City, Wichita, and Topeka. The gas is sold wholesale to distributors, who take over at the city limits.

Losers Win the Spending Title in California Fight

SACRAMENTO.—California's battle over conservation cost operators in the state nearly $5,000,000, final figures filed with the secretary of state reveal.

Proponents of the soundly defeated measure picked up tabs totaling $3,450,211. The opposition paid $1,424,323 for its successful fight.

Heaviest contributor was Richfield Oil Corp., which listed expenditures of $408,873 in support of the bill and a $257,845 contribution to the San Francisco public-relations firm which handled the proponents' campaign.

These figures do not include an estimated $2,000,000 spent by Richfield for preliminary promotional and educational programs the company had conducted in the state for several years prior to the campaign.

On the winners' side, Union Oil Co. of California was the biggest spender. The company handed out $210,068. Two other heavy contributors, both on the losing side, were Standard Oil Co. of California, with $223,624, and Shell Oil Co., with $97,241.

watching WASHINGTON

. . . with Bertram F. Linz

Stevedores and European aid . . .

THE Government's injunction suspending the strike of longshoremen on the East and Gulf coasts expires February 12. And Europe's need for oil may push the administration into drastic action if the issue is not settled by then and the stevedores walk out.

Tanker workers are not directly involved in the fight. But when the stevedores strike, it usually results in a pretty complete tie-up of ports. If that occurs in February, Europe will be cut off from U. S. oil as well as that from the Middle East.

Administration officials haven't indicated how they think such a crisis can be met. A somewhat similar situation was faced by former President Truman a few years ago in a railroad strike. He threatened to induct the strikers into the Army if they didn't stay on the job.

It has been suggested that the President might call on the Army to man the docks, as has been done in England on occasion. That wouldn't be popular with either the Army or the stevedores. It is more generally believed that if necessary he will find some authority in the Defense Production Act to keep the situation under control until the strike issues are settled.

From conservative to liberal . . .

UNDERSECRETARY of State Herbert Hoover, Jr., will resign January 31 in the first major change in President Eisenhower's second-administration team.

A number of other changes in top government posts are also in the cards, however. They will come at intervals over the next few months as men who have served for periods running up to 4 years drop out.

Hoover, who came to the fore by negotiating a settlement of the British-Iranian oil dispute, took over the second top job in the State Department in August 1954. In the many absences of Secretary Dulles he had much of the responsibility for running the department.

He is conservative on the matter of foreign aid and has been criticized for his approach to Middle East problems. In several instances his decisions have been overruled.

Hoover, who is expected to return to the engineering field in which he made an international reputation, will be succeeded by Massachusetts Gov. Christian A. Herter. Herter, who served 10 years in Congress before two terms as governor, is a liberal on foreign policy. In some quarters he is seen as the successor to Dulles should the latter's health require his retirement.

Close the barn door . . .

DOMESTIC producers and congressmen from the oil and coal states are taking a dim view of the administration decision to defer action on oil imports until the Middle East emergency ends.

They want the stable locked while the horse is still inside. They believe imports should be controlled now, while they are no problem. They have no confidence that the importing companies will restrain themselves when Middle East oil again becomes available.

All this will add up to an effort in Congress to get quota control next year. Several coal-state members have announced their intention to press for it. Last week, Oklahoma Sen. Robert S. Kerr started a supporting line-up of oil states. Kerr said he will help to work for mandatory quotas to keep imports to their 1954 ratio to domestic oil.

None of the domestic producer associations is satisfied with the delaying action. They, too, are laying plans to get a quota law.

Gloom Lifting from Europe's Oil Crisis

- **France hardest hit nation right now as machinery goes into effect to coordinate tanker and pipeline movements**
- **Sabotage to Kuwait wells only new outbreak marring the smooth efforts of West to fill Middle East oil shortages**

A NEW pattern of tanker movements took shape quickly last week as oil companies in the Western Hemisphere coordinated efforts to keep a steady stream of emergency oil flowing to Europe.

Their announced goal: 850,000 bbl. daily of oil to replace fuel lost by the blocked Suez Canal and blown-up pipelines in Syria.

U. S. Government agencies approved the first two tanker schedules submitted by the Middle East Emergency Committee. This group is composed of representatives from 15 American oil companies doing business abroad and will coordinate the emergency oil effort.

The 15 companies already are moving better than 600,000 bbl. daily to Europe and East Coast from the Gulf Coast. Shipments from that area in November alone exceeded 11,500 bbl. (*The Oil and Gas Journal, December 10, page 80*). A high mobilization official termed this movement "very dramatic action" and added that coordinated efforts should step up the flow of oil.

Meanwhile these other developments last week highlighted the oil industry's share of the Middle East story:

. . . **Sabotage in Kuwait** set one prolific producing well afire and damaged two others.

. . . **Extra demand for U. S. oil** should reach 1,208,000 bbl. daily by the end of December.

. . . **Europe's oil situation** generally is looking up.

Bombs in Kuwait . . . The outbreak of violence in tiny, oil-rich Kuwait came as a surprise. The Middle Eastern Shaikhdom is Great Britain's chief oil supplier.

The wave of sabotage to Kuwait oil facilities left one big well blazing and two others damaged. An expert oil well firefighter from the Myron Kinley organization in Houston quickly went to Kuwait to start control work.

The series of bombings also severed a submarine cable-loading line at Mina-al-Ahmadi, the world's largest crude loading terminal. In all there were 16 explosions, but ability of the fields to keep producing reportedly was not knocked out.

HUGH A. STEWART
. . . Gulf Coast liftings to hit 1,208,000 bbl.

Location of the damaged wells was not immediately clear. Kuwait's entire production, averaging 1,171,000 bbl. daily this year, comes from 200 wells in Burgan and Magwa-Ahmadi fields. The Kuwait Government quickly imposed strict security measures over oil installations after the bombings. The fields were closed to all but authorized persons.

Officials of both British Petroleum Co. and the Gulf Oil Corp., joint owners of Kuwait Oil Co., were inclined to minimize importance of the bombings. Kuwait is a British protectorate and is not a member of the Arab League. It usually is regarded as one of the more stable countries among the Arab nations.

The tanker plan . . . M.E.E.C.'s new plan of action now going into effect is expected to increase efficiency of tanker movements by 25 per cent.

Washington officials now stress a fact known to oil men in the Southwest for weeks: Moving oil from the fields to the gulf is the limiting factor, rather than tanker space.

Government authorities place the load limit on pipeline and railroad movement at 850,000 bbl. daily, which is considered high by some industry sources. But Washington will not estimate how long it will take to build the movement to 850,000 bbl.

Nominations made by oil purchasers to state conservation agencies within the next few weeks may put the picture into better focus. These in turn will determine state allowables.

In this connection, Louisiana last week decided to retain its December allowable through January. Conservation Commissioner John B. Hussey said he felt Louisiana had done its share of boosting allowables and should now wait to see the effect on wells and transportation.

Louisiana's December allowable is about 975,500 bbl. daily. Allowing for new production, the January figure actually should rise to 995,500 bbl. daily.

The M.E.E.C. plan of action to move this oil includes:

. . . **Western Europe** getting oil which normally moves from Persian Gulf to U. S. East Coast and Canada and oil which usually moves from Caribbean to the east coast of South America.

. . . **Mediterranean area** getting oil which usually moves from Eastern Mediterranean to Western Europe.

The U. S. East Coast and Canada will be supplied from Gulf Coast sources. Eastern South America will be supplied from the Caribbean by an unusual plan. It calls for the tankers hauling oil from Persian Gulf to Europe to return empty to Caribbean region, pick up oil, take it to South America, and then return in ballast to Persian Gulf.

Tanker availability in the last half of December has been estimated at slightly over 1,200,000 bbl. daily. January availability is placed at 778,000 bbl. daily, but is expected to increase beginning in February.

Some changes . . . Several amendments were made last week to the Middle East emergency plan first drafted in August. They include changes permitting:

. . . **Organization for European Economic Cooperation** in London to rule where shipments will go. Thus O.E.E.C. will be able to divert tankers to areas where oil shortage is most critical.

. . . **American oil companies** to buy, lend, and exchange oil between themselves and with domestic operators within the United States as they are allowed to do abroad.

The coordinated program prompted criticism from Sen. Joseph C. O'Mahoney of Wyoming. He declared it per-

mitted oil companies to form a cartel. O'Mahoney suggested the Government take over actual handling of the operation. Office of Defense Mobilization officials retorted nothing would be gained by such a move and assured him the Government was keeping a close check on antitrust aspects of the program.

Gulf liftings . . . The Interstate Oil Compact Commission meeting last week at Miami Beach, Fla., was told the Gulf Coast will be busy late this month.

Hugh A. Stewart, director of the Interior Department's Office of Oil and Gas, said the M.E.E.C. plan calls for lifting 1,208,000 bbl. daily of crude, fuel oil, and distillate from Gulf Coast ports in the last 2 weeks of December. Destinations will be Europe, the East Coast, and Canada.

From another source the the Compact Commission heard an estimate that the Suez closing will create a demand for domestic crude in the range of 7,800,000 to 7,900,000 bbl. daily during the first half of 1957. The pre-Suez forecast was 7,100,000 bbl. daily.

This came from the advisory report of Minor S. Jameson, Jr., vice chairman of the supply and demand committee of the Independent Petroleum Association of America.

Jameson made a guess that during the first half of next year Europe may be able to get an average of 350,000 bbl. per day by pipeline from Saudi Arabia, 200,000 bbl. through the Suez Canal or the Iraq pipeline (assuming partial resumption of traffic through either or both these during that period), and 750,000 by tanker around the Cape of Good Hope—a possible total of 1,300,000 bbl. per day of Middle East oil.

From the Western Hemisphere Jameson estimated that Europe may get an average of 700,000 bbl. per day from the Caribbean and 500,000 bbl. per day from U. S. gulf ports. Shipments of 500,000 bbl. per day from the U. S. would represent an increase of 420,000 bbl. per day over pre-Suez U. S. exports. In addition, domestic crude will be called on to replace around 300,000 bbl. per day which would have been imported into this country.

Outlook in Europe . . . With rationing and higher prices curbing use of oil products in most Western European countries, the over-all situation is not as black as first supposed.

Sir Leonard Sinclair, managing director of Esso Petroleum Co., on his return to London from the U. S., stressed the more optimistic outlook. He said: "The outlook for U. S. oil supplies for the next few months is not too dismal, providing consumers exercise reasonable economy."

This was the situation in other European countries:

. . . France, dependent on the Middle East for 90 per cent of its requirements, appears to be most hard hit. Supplies are reported on hand for only 2 weeks' need.

. . . Italy is reported to have enough crude oil and refined products to last 2 months. Diesel oil and fuel oil stocks are the most critical. Italy normally gets about 95 per cent of its oil from the Persian Gulf area. But Italy may benefit from the Saudi Arabian bar against shipments to England and France. Negotiations are under way to get these quotas for Italy.

. . . Belgium's position is reported excellent. Little storage space is available and stocks on hand are above normal. Four tankers—two each from Persian Gulf and Venezuela—arrived at Antwerp early in December with 700,000 bbl. of crude.

. . . Sweden expects big deliveries this month to put her oil stocks in good shape.

Shell is scheduled to receive 11 tankers and British Petroleum 19 during this month. Gulf and Esso got about 1,800,000 bbl. of crude in the first part of the month to bolster their supplies.

. . . Holland has stocks equal to 2 or 3 months' supply. Its products position is favorable since Holland normally is an exporter of refined products. It also is less dependent on Middle East oil, getting about half of its crude from the Persian Gulf, 40 per cent from the Western Hemisphere, and 10 per cent from the Far East.

. . . Norway is feeling a pinch. Large-volume consumers have been notified to expect a 25 per cent cut in allocations. A 10 per cent reduction to all consumers is now in effect.

Big recovery hoped for at . . .

. . . New Texas Cycling Plant

MOUNT VERNON, Tex.—Operators in the New Hope field of Northeast Texas will soon launch a $2 million cycling program which is expected to recover up to 80,000,000 bbl. of condensate from the Smackover lime.

The project, already cleared by the Texas Railroad Commission, will be carried out by the newly authorized New Hope Deep Unit, with Tidewater Oil Co. as unit operator.

The Smackover at 11,400 ft. is the deepest of five pays in New Hope. It is a simple northeast - southwest anticlinal feature. There currently are five producing wells in the reservoir, all shut in, with a deliverability figured at more than 50,000,000 cu. ft. daily.

The unit plans a plant capable of injecting up to 15,000,000 cu. ft. daily. Initially, however, compressor capacity will be installed to handle only 5,000,000 cu. ft. This volume will be injected through a single input well, the 1-D T. J. Ramey.

Operators in the field believe that liquid recovery will be hiked by at least 8,000,000 bbl. and possibly as much as 80,000,000 bbl. by cycling to prevent liquids loss due to retrograde condensation.

Gas produced from the Smackover in New Hope is unusually rich. Field separator tests recovered an average of 150 bbl. per million cubic feet. Tidewater estimates that the projected plant will recover about 170 bbl. per million cubic feet.

Corrosion problem . . . Unfortunately, the gas is also sulfurous, containing 14 per cent hydrogen sulfide (along with 4 per cent carbon dioxide and 8 per cent nitrogen). This has raised a knotty problem in building compressor facilities which will resist sulfide corrosion.

The pay formation above water averages 394 ft. thick and is tight. Permeability throughout the gross pay section is estimated at about 0.2 md. Constant rate production and pressure buildup tests indicate, though, that there is good communication between wells. Operators so far have been unable to fracture the pay, but the limestone has been found quite soluble in hydrochloric acid.

Tidewater thinks cycling the Smackover pay will be more feasible and practical than water flooding. Viscosity of the gas is about 0.04 cp., while that of water under reservoir conditions is 0.22 cp.

Remaining working interest in the unit, other than that of Tidewater, is held by Seaboard Oil Co. and R. C. Oberthier. Working interest was 100 per cent signed and royalty interest 98 per cent signed when the unit agreement was approved.

Unit participation is based 100 per cent on surface acres. It will remain on that basis until January 1, 1960, or to any earlier date at which productive limits of the Smackover are defined and productive acre feet can be calculated.

Florida Gas Ruling Due

Waiver of intermediate decision and oral argument makes possible FPC ruling this year on Texas-Florida pipeline

HOUSTON.—Outlook for early construction of a major natural-gas pipeline to Florida brightened considerably last week.

Cause for renewed optimism was an order by the Federal Power Commission omitting the customary intermediate decision in applications filed by Houston Texas Oil & Gas Corp. and Coastal Transmission Corp. These two Houston-based companies propose to build a line from the lower Rio Grande Valley in Texas to transport natural gas to Florida.

The FPC's action paves the way for a possible early decision without which the entire proposal might be delayed indefinitely. Unless final action is taken by December 31, the commission noted, Coastal Transmission's purchase contracts will be subject to cancellation.

The commission indicated that it plans to rule on the joint proposal before expiration of the contract deadline. It gave opponents until December 15 to file briefs arguing against the plan. Coastal and Houston then will have until December 20 to file reply briefs.

Coastal pointed out in its main brief that the initial price of its gas will average 16.8 cents per M.c.f. "This is the lowest price at which this gas could be bought and could not be duplicated today," the company stated.

FPC thinking . . . The FPC, in adopting the abbreviated procedure, said it was "giving primary consideration to the public interest" and not setting a new precedent. The commission warned that it was "not adopting a policy of permitting applicants to fix and assert date deadlines . . . as a grounds or basis for waiver of the intermediate decision procedure."

The commission added, however, that it appeared unlikely a decision could be rendered before December 31 unless the intermediate decisions were omitted.

What is proposed . . . Combined projects of Coastal Transmission and Houston Texas Gas & Oil would include 1,517 miles of main line and 1,097 miles of lateral lines. Total cost is estimated at $148,564,000.

The proposed system would have an initial capacity to move an average of 250 million cubic feet of gas per day to Florida markets. It will be designed for an ultimate capacity of 400 million cubic feet per day.

Coastal's portion of the line would extend from Hidalgo County near the southern tip of Texas to Baton Rouge. From that point Houston Texas Gas & Oil Corp. would build a 24-in. line to Florida.

Coastal's brief indicates the company has contracted enough proved gas reserves to meet the line's minimum requirements for more than 20 years.

The company has contracted for direct purchase of 824,275,000,000 cu. ft. of gas. This supply is dedicated by 47 purchase contracts with 33 producers covering reserves in 37 Texas and Louisiana fields. In addition, more than 1 trillion cubic feet of "transportation gas" has been contracted to Florida utility companies. This supply would be moved through the Coastal-Houston system on a contract basis.

The Texas-to-Florida project is the first major new system since the Phillips decision to contract its entire gas supply within the United States, Coastal said.

"The unfavorable climate for the purchase of gas for interstate resale use made the assembling of Coastal's gas supply most difficult," it added. "The jurisdictional problems resulting from the Phillips decision and the subsequent veto of the Harris bill made many producers unwilling to commit their gas to interstate use."

Initial prices to be paid by Coastal range from 16 to 18 cents per M.c.f. in Texas. In Louisiana the company contracted for gas at 18 cents per M.c.f., plus 1 cent for state gathering tax. Escalation clauses provide an increase of 1 cent per M.c.f. at the end of each 5-year period during the 20-year term of the contracts.

The FPC staff counsel also has recommended omission of the intermediate decision in producers' applications for certificates to sell gas to Coastal.

The market . . . Houston Texas Gas & Oil pointed out in its brief that the proposed service area will have a population of about 2,150,000 people by the time deliveries start.

The company argued that use of natural gas for generation of electricity will result in lower utility bills for Florida consumers. Florida is now 99 per cent dependent on imported energy.

It was estimated that the Coastal-Houston lines would result in a savings to Florida residents of $14,566,000 in the first year of operation. This benefit is expected to total $16,597,000 in the second year of operation and $18,403,000 in the third year.

Socal Forms Western Subsidiary

LOS ANGELES.—Standard Oil Co. of California has formed a wholly integrated subsidiary to manage the firm's petroleum operations in seven western states, Alaska, and Hawaii.

E. J. McClanahan, a director and vice president of the parent firm, will be chairman and president of the new Standard Oil Co. of California, Western Operations, Inc.

This further decentralization by the parent company, effective January 1, will make the new subsidiary the largest oil company in the West. Consolidation of Standard's western activities began 2 years ago when a separate western division was formed.

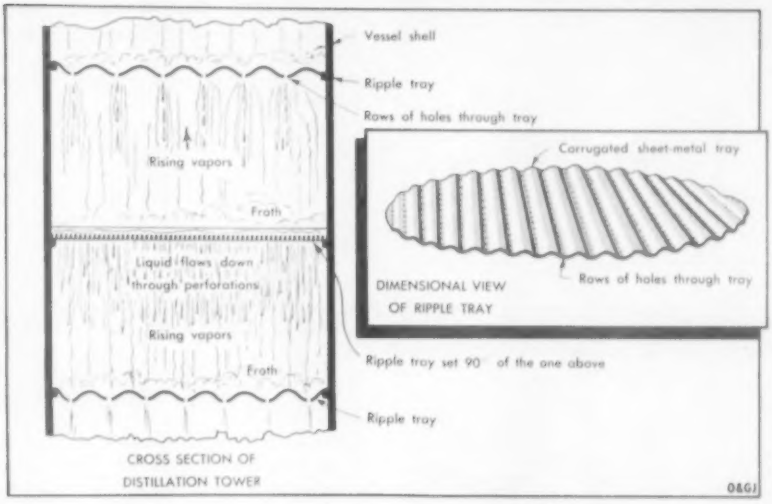
Oil production for the Western division averaged 117,000 bbl. daily last year. Refining capacity is at 300,000 bbl. Sales totaled nearly $726,000,000 for the year.

Board Chairman R. G. Follis and President T. S. Petersen said decentralization will free Standard of California's corporate executives from day-to-day operating responsibilities so that they can devote more effort to long-range planning and policy.

E. J. M'CLANAHAN
. . . to head West's biggest oil firm.

Some 25,000 employes of the present Western division will be transferred to Standard-Western operations effective the first of the year.

How the New Fractionation Tray Works



Ripple Trays Boost Capacity

BOSTON.—Latest entry in the field of perforated plates — the ripple tray—is gaining a reputation for high capacity, low cost, operating flexibility at high loads, and a special self-cleaning feature.

The new fractionation tool has boosted capacity of one crude unit more than 50 per cent when substituted for conventional bubble cap trays.

A new development of Stone & Webster Engineering Corp., ripple trays are simple perforated trays pressed into sinusoidal waves. They are made from light gage sheet metal, with Type 410 stainless steel satisfactory in most cases.

Application . . . Alternating trays are placed at right angles in a column. Both liquid downflow and vapor upflow pass through the perforations, eliminating downcomers. Good distribution is afforded, and no redistributors are needed between trays.

Ripple trays are fabricated in sections to pass through an 18-in. manhole, and are bolted together inside the tower and clamped to a narrow support ring. Their rigidity precludes tray support beams up to a diameter of 9 ft.

Hole size and depth of corrugation can be varied to meet specific requirements. Shallow waves are pressed into the trays for low liquid loading under 500 gal. per hour per square foot, and the deepest waves will handle loadings over 2,000 gal.

High capacity . . . The tray's high capacity was illustrated by M. H. Hutchinson of Stone & Webster, and R. F. Beddour of Massachusetts Institute of Technology, at the forty-ninth annual meeting of the American Institute of Chemical Engineers in Boston recently.

A 20-000-bbl. per day crude unit was converted from conventional bubble cap trays to the new ripple trays. Runs, using the same tower shells, were boosted to 31,000 bbl. daily, with comparable fractionation efficiency.

The new trays also afford low pressure drop, Hutchinson and Beddour reported. Vapor rates can be double those attained in bubble cap tray towers, operating at the same pressure differential.

Self-cleaning . . . Agitation on the tray plus continual wetting and washing on the underside make the trays self-cleaning. In one instance, trays with ¼-in. holes were substituted for bubble cap trays in a tower producing clean distillate from tarry visbreaker effluent.

Original trays coked almost solid after a few weeks of operation, but the new type was still clean after an extended operating period.

For clean service ⅛-in. holes are standard, but larger perforations are specified for fouling conditions. Total open area ranges from 15 to 30 per cent of tower cross section.

The new trays are receiving wide refinery application. They are now being used, or are being installed for gasoline stabilization, atmospheric and vacuum crude fractionation, demethanizing, depropanizing, ethylene-ethane separation, propylene recovery, isopentane recovery, gasoline rerunning, cracked gas quenching and numerous chemical applications.

Merger of two gas lines attacked:

California Monopoly Charged

SACRAMENTO.—California's Atty. Gen. Edmund G. Brown has asked the federal Government to investigate the possibility of antitrust violation in the recent acquisition of Pacific Northwest Pipeline Co. by El Paso Natural Gas Co.

In a letter to U. S. Atty. Gen. Herbert Brownell, Brown declared that the merger would result in "suppressing competition and creating a monopoly in the furnishing of gas in interstate commerce in California."

El Paso Natural Gas is California's sole supplier of imported gas at present, and Brown said El Paso should have competition to help force prices down.

Pacific Northwest might have provided that competition through its 1,466-mile gas line which is being completed from the San Juan basin in Colorado to the Canadian border, but the merger would restore the "monopoly situation," Brown added.

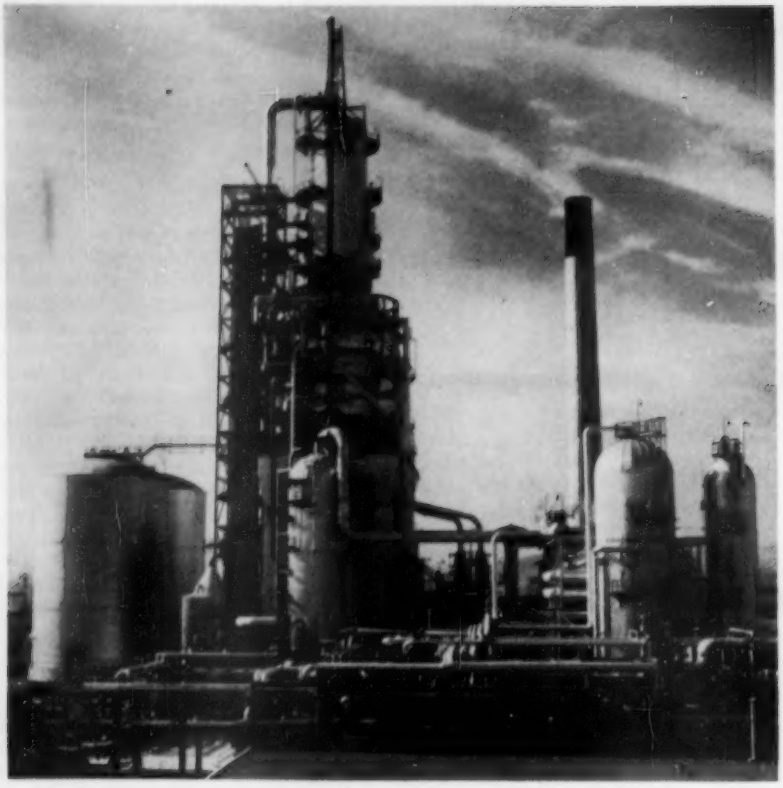
Both Pacific Northwest and El Paso have been looking ahead to the time when the Pacific Northwest line will be reversed and Canadian gas will flow to California. A new pipeline would probably be required to connect the Pacific Northwest system to California.

El Paso announced plans to absorb Pacific Northwest last month through a stock exchange involving around $140 million *(The Oil and Gas Journal, November 12, page 130).*

Big flow involved . . . Together the merged companies will transmit nearly 2½ billion cubic feet daily. Pacific Northwest will have initial capacity of 343 million, and El Paso's recent expansion program gives it capacity of more than 2 billion cubic feet daily into California.

El Paso's gas is produced in the Texas-New Mexico Permian basin, and the Colorado-New Mexico San Juan basin. The principal market is California.

The merger, which must be approved by the Federal Power Commission, would make El Paso one of the biggest transmission companies in the nation, and the dominant transmission company in western United States.



Tidewater sees more flexibility at Avon as . . .

Giant Coker Goes on Stream

SAN FRANCISCO. — The nation's largest coking unit was placed on stream at Tidewater Oil Co.'s Avon refinery near here last week.

The 42,000-bbl. fluid unit will help solve the company's residual oil problem by reducing output of heavy fuel to less than one-third. Until a planned coke-burning boiler is completed, however, most of the 600 to 700-ton daily coke output will pile up in the refinery yard.

Initial operations are at a 26,000-bbl. charging rate. Full capacity will not be reached for 6 to 7 years, until planned additions in thermal and catalytic cracking capacity are placed in operation. Coke output at full capacity will be some 1,200 to 1,500 tons daily, according to properties of the charge stock.

The unit will operate on a mixture of vacuum-tower bottoms and low-gravity, high-sulfur crudes from local fields and the Middle East. Amount of paraffinic-base, Neutral Zone crude charged will be determined by the amount of hydrogen available from reforming operations.

A 28,000-bbl. visbreaker which has been handling the vacuum bottoms is being partially converted to thermal gas-oil cracking. About 10,000 bbl. of the unit's capacity will continue in catalytic cracking service.

More expansion . . . The new coker—a duplicate of one the company soon will start at Delaware City, Del.—is part of an approximately $35,000,000 product upgrading program which has resulted in a 20 to 30 per cent increase in gasoline yield.

The coker will give Tidewater greater flexibility in residual oil output. During times of oversupply, more residual can be converted to coke. When supplies are tight, more raw crude can be charged.

Other units involved in the program include a 24,000-bbl. hydrodesulfurizing unit for the coker, and a 10,000-bbl. Hydrobon Platformer. Work will start soon on a 22,500-bbl. Houdriformer which will be completed in early 1958. Ultimately to be expanded to 45,000 bbl. capacity, the unit will make available additional hydrogen for cleaning up coker streams.

The planned steam generating facilities will be designed to operate on the fluid coke, augmented by 10 per cent of auxiliary fuel. When it is in operation it will use 170,000 tons of coke annually, about one-third of the new unit's full capacity. If Tidewater should go to full power generation via the coke route, the coker's entire output would be required.

Tidewater expected to have the new unit in routine operation by the first of the year. To start it up, about 4,000 tons of seed coke was shipped from Carter Oil Co.'s 3,800-bbl. fluid coker at Billings, Mont.

Deep Offset Drilling

R.&B. below 19,000 ft. in stepout from deepest hole

PORT SULPHUR, La.—Richardson & Bass has resumed drilling on the 1 Humble-R. F. Price et al., offset to the world's deepest hole and deepest producer.

The Price well is already below 19,000 ft. and is looking for sands that may be found as deep as 22,000 ft.

Drilling was temporarily suspended in September to move Rig 25 back to the record-holding 1 L.L.&E.-Humble-State Lease 2414. Earlier this year, Rig 25 had drilled the hole to a record depth of 22,570 ft. and completed it as the deepest producer at 21,465 ft.

After producing several weeks, the well sanded up, and Rig 25 was moved back to the 1 L.L.&E. where it is still working.

Richardson & Bass succeeded in placing a slotted liner through the producing interval on the record-depth well. Attempts to acidize the formation have thus far been unsuccessful and work continues.

New rig moves in . . . Original plans had called for moving Rig 25 back to the neighboring Price well as soon as the workover was completed. But the job ran into complications and time stretched out longer than expected. So, Richardson & Bass have moved another rig—Rig 10—onto the Price well to resume operations there.

Target for the Price well are sands found below 21,000 ft. in the discovery well. The hole is cased with 7-in. to 18,595 ft. It had originally been abandoned at 11,500 ft. in 1954 by another company.

West Coast Refinery Planned

LOS ANGELES.—Standard Oil Co. of California will build a new refinery near Everett, Wash., with a capacity in the range of 60,000 to 100,000 bbl. per day.

Construction on the proposed $65

million plant will not get under way for another year. It will be built on a 2,400-acre tract already held by the company in that area.

In addition to the Washington project, T. S. Petersen, president of the firm, said Standard of California still plans to build a 25,000-bbl. refinery in Hawaii, although the site has not been acquired yet. Petersen was speaking before the California Petroleum Press Club.

Other new refining construction slated on the West Coast includes the Texas Co.'s proposed plant in the Anacortes, Wash., area. Details will be announced soon.

Shell Oil Co. is working on plans for expansion of the Wilmington-Dominguez refinery in the Los Angeles area.

Ethyl Cuts Back

Gulf Coast output reduced to fall in line with demand

HOUSTON. — Ethyl Corp. has announced a "limited cutback" in operations of its Houston and Baton Rouge plants. The adjustment will involve laying off about 65 of the company's 1,000 Houston employes soon after January 1.

The cutback was attributed to reduced sale of sodium and to the fact that the use of tetraethyl lead had not reached expectations.

Although gasoline demand has grown this year, "that increase has been less than the industry expected," the company stated. "This, together with the new installation of catalytic reforming units, has resulted in less use of 'Ethyl' fluid than had been expected."

A major part of Ethyl's sale of sodium, which is bought by detergent manufacturers, has been canceled because of competitive processes and materials in the soap industry, the company explained.

"As a result we will have to reduce the number of sodium cells which we operate country-wide."

New plants . . . Ethyl recently started operations at a new plant in Canada and announced plans for a new West Coast plant.

"It was necessary for us to build our Sarnia plant because our Canadian customers wanted a plant in Canada to meet their growing needs," officials added.

"Because we operate in a highly competitive business, we announced plans to build a plant in California to serve the long-range future needs of the West Coast oil industry and in order to protect our business in that area."

Processing briefs

Sinclair Refining Co. has signed a 20-year charter on a 32,650-d.w.-ton tanker now being built at Bethlehem Steel Co.'s Sparrows Point, Md., shipyards for Commerce Tankers Co., Inc.

The 661-ft. tanker will bring Sinclair's tanker fleet, either owned or chartered, to more than 480,000 d.w. tons—more than double that of 5 years ago. The new tanker will have a crude capacity of 214,000 bbl. and will be used in coastwise and near-foreign trade. Keel was laid September 10. It will be launched next April and is scheduled for delivery in July.

Shell Chemical Corp. plans a two-stage expansion program to boost its production of isopropyl alcohol by 120 million pounds a year. The first stage amounting to about 70 million pounds per year will be completed in 1957 and the second stage in 1958. The expansion will include new facilities at three plants: Houston, Norco, La., and Dominguez, Calif.

The expansion is spurred by normal growth of principal uses and discoveries of new applications for some solvents and their derivatives.

Douglas Oil Co. of California will build a new Unifining unit at its Bakersfield refinery. Contract was awarded to Macco Corp., with completion scheduled June 1. The new unit is the first step in a $1,250,000 expansion and modernization program, which will include a new 12,000-bbl. topping plant.

Construction of a new 1,560-bbl. alkylation unit for National Cooperative Refinery Association has been completed at McPherson, Kans. Design and construction was by Refinery Engineering Co., Tulsa. The unit is licensed by Universal Oil Products Co.

Dr(2-ethylhexyl) amine, an oil-sol-uble secondary amine used to prepare corrosion inhibitors and antigumming agents for gasoline and fuel oil, is now available in tank car quantities at a new reduced price of 75 cents per pound, according to Union Carbide & Carbon Chemicals Co. The intermediate is also used for making oil emulsion breakers, insecticides and rubber accelerators.

Sioux Oil Co. is building a $100,000 natural-gasoline plant at Newcastle, Wyo. The plant will have a capacity of about 4,000,000 cu. ft. daily. Dry gas from the plant will be used as fuel at Sioux's two small refineries at Newcastle.

Shell Chemical Corp. has completed two new Epon resin units at its Houston plant. One of the units will produce liquid grades of epoxy resins and the other will produce solid grades. The two units will triple production of epoxy resins at the Shell plant.

Ethyl Corp. has discovered a new process for making tetraethyl lead. Radically different from any process in use or proposed, it involves a reaction between a metal alkyl and a lead compound. Development is still in the early stages, but the process promises to short-cut intermediate steps now used. Ethyl will have further details soon.

Also for Refiners . . .

O.C.A.W. policy committee hammers out new bargaining terms—including a 27-cent hourly minimum wage demand (P. 85) . . . Ripple tray developed by Stone & Webster is earning a reputation for boosting capacity (P. 91) . . . The nation's biggest fluid coker—a 42,000-bbl. unit—has gone on stream at Tidewater's Avon refinery near San Francisco . . . Standard of California's Petersen says construction will start next year on big refinery at Everett, Wash. (P. 92) . . . Ethyl cuts back TEL output at Houston and Baton Rouge (P. 93) . . . Union Oil will start producing oil at its shale-oil pilot plant in Colorado next February . . . General Aniline & Film will use Bayway ethylene for plant now going up at Linden (P. 94) . . . I.R.A.A. alarmed over prospects of domestic crude price hike (P. 104) . . . Expansion in refining and petrochemicals is in the books for Brazil . . . Iraq Government will double capacity of 24,000-bbl. refinery at Baghdad (P. 105) . . . Richmond uses workover rigs to erect tower at Venezuelan refinery (P. 107).

PLUS THESE TECHNICAL FEATURES: The Journal's editors give a complete rundown on gas chromatography. It's good for refining, natural-gasoline, and petrochemical plants (P. 126) . . . Estimating fuel-oil markets with climatic odds (P. 122) . . . The Foreman's Page (P. 143) . . . Refiner's Notebook (P. 145) . . . and Questions on Technology (P. 146).

A retort will finish the picture:

Shale Oil to Flow in February

GRAND VALLEY, Colo.—Union Oil Co. of California will begin producing oil in February at its $5 million oil-shale experimental station near here.

Union's shale mine and crusher system (above) recently underwent shakedown tests. The last unit needed for oil production—a 300-ton pilot retort—will be completed soon.

Shale is carried to the plant over a 4-mile aerial tram in buckets (see arrow). It is then conveyed up to a secondary crusher (center foreground) and on to a screening tower (in front of tank).

From the stockpile at upper right, the shale is carried up the ramp to the retort, on the mound behind the tank.

What's involved . . . Colorado has the world's largest deposit of commercial grade shale. If Union's experiment is successful, it could lead the way to development of the vast body of shale in the Piceance Creek basin, where reserves are believed sufficient to produce about 900 billion barrels of oil.

A. C. Rubel, president of Union, expressed confidence that shale oil can be produced at a cost low enough to compete with natural oil. A great deal of money has been invested in the operation since the project began in June 1955.

At nearby Rifle, Colo., the U. S. Government began experimenting with the economic feasibility of converting shale into oil about 9 years ago. But operations were halted last June when Congress refused to make appropriations for continued operation.

Members of Colorado's congressional delegation recently announced they plan to ask Congress to reactivate the research plant at Rifle, with the Navy conducting the project *(The Oil and Gas Journal, December 3, page 82)*.

The legislators were spurred on by the Middle East crisis and because of failure—with the exception of Union—of private industry to experiment with shale.

Strike Hits National Supply

LOS ANGELES. — Nine-hundred production workers at National Supply Co.'s Torrance plant walked off their jobs last week, slowing down operations of California's largest integrated oil-field equipment firm.

The strike began after a breakdown in negotiations with the Oil, Chemical and Atomic Workers International Union (AFL-CIO) on four major issues.

The company and union were 2.1 cents per hour apart on wages and couldn't agree on retroactive date for wage settlement; premium pay for weekend work; and payment to the unon grievance committee chairman for time spent in handling disputes.

New Complex Grows

G.A.F. plant is latest user of ethylene from Bayway

NEW YORK. — General Aniline & Film Corp. has awarded contract to SD Plants, Inc., to build an $8-million plant at Linden, N. J., to produce ethylene oxide and ethylene glycol. Work already has started.

The petrochemical installation is located adjacent to Esso Standard Oil Co.'s 172,700-bbl. Bayway refinery which will supply ethylene for this process.

G.A.F.'s plant will be capable of producing annually 60,000,000 lb. of ethylene oxide and 35,000,000 lb. of ethylene glycol. It will use the direct air oxidation process developed and licensed by Scientific Design Co., New York. Scientific Design is handling design and engineering for its construction subsidiary, SD plants.

G.A.F. is the second chemical company to contract with Esso for ethylene. Hercules Powder Co. is now building a 30,000,000-lb. per year polyethylene plant at Parlin, N. J., about 13 miles southwest of Linden. Ethylene will be moved to Parlin by a new pipeline being built by Esso.

Esso has not yet revealed total capacity of its new ethylene plant at Bayway, but it will at least equal the 70,000,000-lb. annual volume which has been contracted to the G.A.F. and Hercules plants. Other possible users of Esso ethylene along the pipeline right-of-way have not yet been announced.

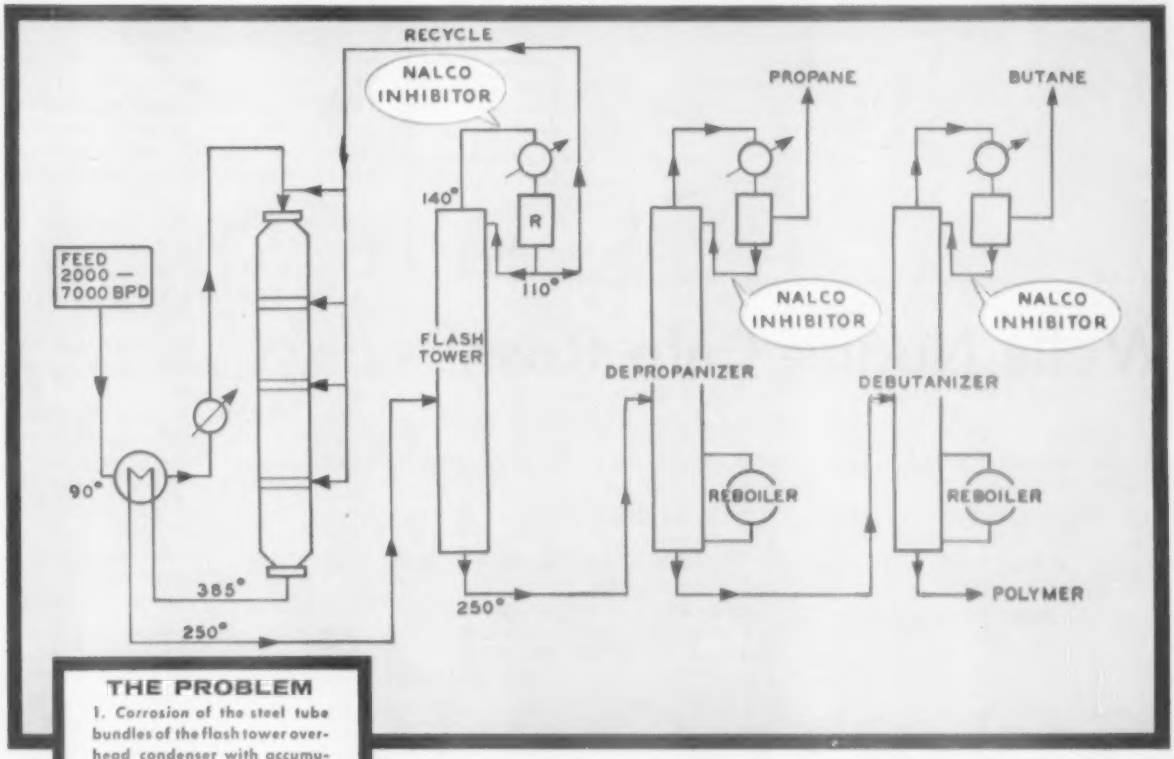
Busy builder . . . The G.A.F. plant is the eighth ethylene-oxide installation whose design, engineering, and construction have been undertaken by Scientific Design.

Other plants have been contracted in the U. S., Europe, and Japan for Allied Chemical, Bayer, Mitsui, and Naphtachimie. SD Plants subsidiary was reorganized only last year and already has completed two polyvinyl chloride plants for Eleonora Chemical Co. at Passaic, N. J., and the Borden Co. at Leominster, Mass. A third pvc plant is under construction for Cary Chemicals Co. in Flemington, N. J.

Nalco INHIBITORS

STOPPED CORROSION and FOULING

in this CATALYTIC POLYMERIZATION UNIT



THE PROBLEM

1. *Corrosion* of the steel tube bundles of the flash tower overhead condenser with accumulator water pH of 4.5 or below.
2. *Serious fouling* of screen trays in the depropanizer and debutanizer on normal six-month run.

THE TREATMENT

Nalco Inhibitor fed to the overhead of the flash tower, and to the reflux of the depropanizer and debutanizer towers.

THE RESULTS

1. Iron content of accumulator water reduced from .75 pounds per day to .04 pounds per day.
2. No deposits in screen trays after six-month run.

CONSIDER further the economy of dosage . . . 10 ppm to flash tower, and 10 ppm to depropanizer and debutanizer. And bear in mind that this was no isolated success story. The same advantages—less downtime, better thruput *and* effective protection for costly equipment—can be brought to your refinery by the use of Nalco Corrosion and Fouling Inhibitors. Ask your Nalco Representative or write direct.

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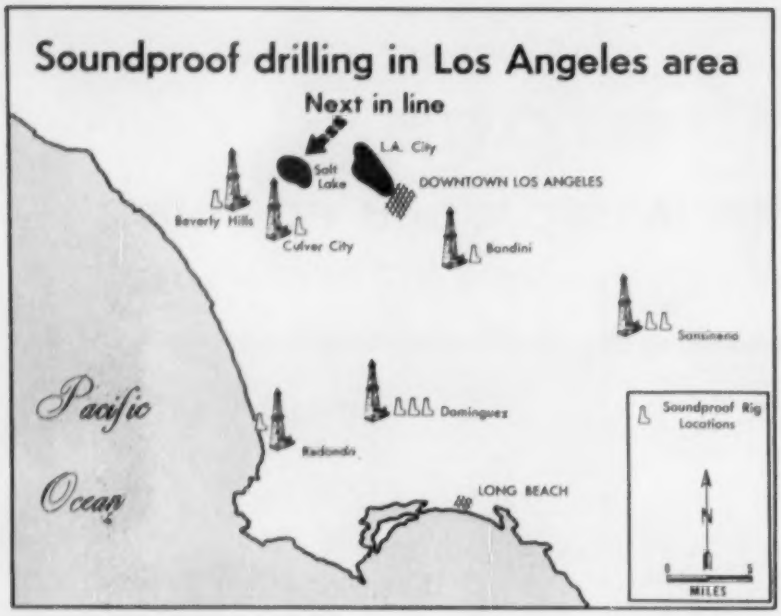


Wells Nudge Cafe Row

● Los Angeles permits redrilling old Salt Lake field in swank residential area; it may mean new life for others

LOS ANGELES.—Prospects for deep exploratory drilling in the residential areas of metropolitan Los Angeles got a boost last week.

The city council approved plans of Morgan Brown, Beverly Hills oil producer, to drill in the area of the old Salt Lake oil field in the western section of Los Angeles.

Brown will slant drill about 20 deep tests from a 2-acre site located in the center of a 43-acre parcel. The area is in an expensive residential district a few blocks west of Los Angeles' famed restaurant row on La Cienega Boulevard north of Wilshire Boulevard.

The outlook . . . One factor likely won city council members over to permitting redrilling in the city limits: Favorable experiences by outlying communities with town-site drilling.

Drilling contractors and oil operators have drilled in Culver City, Beverly Hills, Bandini, Sansiena, Dominguez, and Redondo Beach *(The Oil and Gas Journal, October 8, page 184).*

They developed a new technique of drilling to placate fears of homeowners that their property would be damaged. Methods included:

. . . **Soundproofing** the entire rig.

. . . **Screening** drilling operations behind attractive fences and beautiful landscaping.

. . . **Slant-drilling** several holes from a single location.

. . . **Producing with down-hole pumps** and muffled motors.

Now that new drilling has returned to Los Angeles proper, several other old fields may be redrilled.

Both Union Oil Co. and Richfield Oil Corp., among the majors, and a number of independent oil operators are known to be obtaining leases in the areas of some of these metropolitan fields.

Such an area is within a mile of the city hall in the old Los Angeles City field. It still is producing about 130 bbl. daily from 80 stripper wells. Deepest wells in the field are less than 1,700 ft. Most are less than 1,000 ft., drilled between 1898 and 1900.

Movie production . . . An indication of what may be in store for other sections of Los Angeles can be drawn from drilling on the 20th Century-Fox movie lot.

Several years ago Universal-Consolidated Oil Co. obtained the movie-lot drill site. It first had to make arrangements with the neighboring cities of Beverly Hills and Los Angeles. They called for extensive and expensive noise-abatement and site beautification agreements.

Since, Universal has completed 10 wells which currently are producing more than 3,000 bbl. of crude daily under highly restrictive chokes.

An old field . . . The Salt Lake field was discovered in 1902 and flourished until the early 1920s.

Peak production year was 1908 when yield reached 4,535,800 bbl. from 185 wells averaging 1,900 ft. in depth. By 1915 the field had 350 wells but production had turned downward. Only six wells—all drilled in 1908—are still producing some 200 bbl. daily. Cumulative production in the field to date has reached in excess of 40,000,000 bbl.

The tremendous growth of Los Angeles in the 1920s engulfed surface area of Salt Lake field. The land became more valuable as homesites than as oil property. When homes went up, new drilling restrictions were applied.

Golf Course Drilling Is Below Par

LOS ANGELES.—The City Council here is interested in developing more holes for the city-owned Rancho Park Golf Course.

In an application filed with the City Planning Commission, the council asks permission to drill oil wells on the course which adjoins the 20th Century-Fox movie lot in West Los Angeles.

Neighboring property owners in the exclusive West Los Angeles-Beverly Hills district have been loud and bitter in their opposition to any proposals to create drill sites on the city golf course.

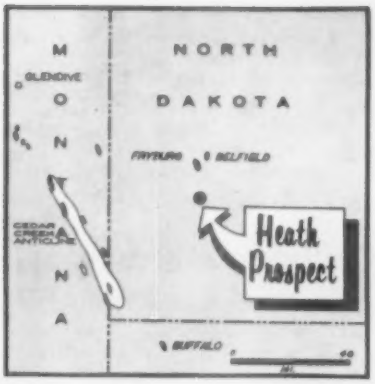
But the council claims that Universal-Consolidated Oil Co.'s highly successful operation on the film studio grounds is draining valuable oil from beneath the municipal links.

Any delay, the council said, will result in considerable financial loss to the taxpayer.

Several oil companies already have filed applications with the planning commission for permission to drill on the country club grounds. The council wants the commission to consider applications of both the city and the oil companies, either granting or denying permission to both.

The film studio operations of Universal-Consolidated are conducted from a soundproof multiple well site, with 10 wells now producing about 3,000 bbl. daily from three zones.

An eleventh well is currently being drilled, but it's on the movie lot and off the fairway, so far as the city council is concerned.



Wildcat Gets Flow

Prospects good for Heath discovery in North Dakota

FARGO, N. D.—A new Heath-Mississippian discovery for North Dakota is in prospect at Northern Pump Co.'s 1 Fritz in Billings County.

Northern Pump was drilling ahead in Otter formation below 8,085 ft. late in the week after encouraging tests between 8,043-81 ft.

In the tests, the well was open 33 minutes and shut in 30 minutes. Gas surfaced in 10 minutes and oil in 28 minutes at a rate of 25 bbl. an hour. Oil flowed for 5 minutes before being shut in. Flowing pressure was 2,779 psi. initially and 3,133 psi. at the end of the 33-minute test. Shut-in pressure after 30 minutes was 3,703 psi. Gravity of the crude was 28°.

The apparent pool opener is 15 miles south and 25 miles west of Dickinson. It is some 80 miles south of the Nesson anticline and 12 miles south of the Fryburg field, a Madison and Heath producer opened by Amerada Petroleum Corp. in 1954.

The wildcat is on a farmout from Stanolind Oil & Gas Co. in the Gaylord area and is 3 miles south of an earlier failure. It was drilled on seismograph information. Original plans called for a 9,300-ft. test of the Madison.

Another discovery . . . Meanwhile, North Dakota has a discovery in the north central section of the state.

It is North Central Oil Co. of Houston 1 Pearson in Bottineau County, 6 miles south of the Canadian border and about 12 miles from production in Kurtki field.

The 1 Pearson had initial recovery of 193 bbl. of oil daily on pump. Production is from the Mission Canyon at the 4,000-ft. level. The well is on a farmout from Sohio Petroleum Co. on what is believed a combination structural and stratigraphic trap. Drilling was on seismographic information.

Pipeline briefs

American Louisiana Pipe Line Co. has awarded the contract for cathodic protection of its 1,200-mile natural-gas system to Cathodic Protection Service, Houston. This early protection of a complete major system represents a new approach in corrosion prevention. The contract is one of the largest ever let for the protection of an entire pipeline on a packaged basis.

Three engineering survey crews are checking current requirements and obtaining other data needed to complete the design. As soon as rectifier ground bed sites have been located and rectifiers sized, materials will be ordered and construction started at the north end of the system. Part of the system has already been placed under protection.

Trans-Prairie Pipelines, Ltd., has linked Weyburn and Halbrite fields in southeastern Sasakatchewan to the Westspur Pipe Lines, Ltd., terrminal at Midale with a 25-mile gathering and transmission system costing $764,000. The crude will be moved to the Interprovincial system for sale in the international market. Weyburn and Halbrite production, now 3,500 to 4,000 bbl. per day, is expected ultimately to increase to 15,000 bbl. daily.

Pasotex Pipe Line Co., will lay 127.5 miles of 20-in. crude line between Wink and El Paso, Tex., next year. Contracts have not been announced but completion is due July 1. Pipe delivery is scheduled to start this week. Some 70 miles of 20-in. has already been laid along the 197-mile, dual 8-in. system.

Permian Basin Pipeline Co. plans to build 83 miles of 16-in. from its Spraberry compressor station in Midland County, Texas, southeast to the Pioneer Gathering System, Inc., line. Application is now before the Federal Power Commission. Permian also will install a 3,960-hp. compressor station in Schleicher County on the line. Cost of these facilities is estimated at $5 million.

The supply contract with Pioneer calls for initial delivery to Permian of more than 50,000,000 cu. ft. daily starting next year. Volume will reach up to 200,000,000 cu. ft. daily. Permian is a subsidiary of Northern Natural Gas Co.

Southern Pacific Pipe Lines, Inc., has started work on its 305-mile products system between Richmond, Calif., and Fallon, Nev. There will be 100 miles of 10-in., 80 miles of 8-in., and 125 miles of 6-in. General contractor has not been selected. Completion is scheduled for August 1, 1957.

Texas Gas Transmission Corp. expects to complete 123 miles of 20-in. gas line in Louisiana this week. Houston Contracting Co. had the contract for the new supply line from Eunice to East Lake Palourde to Thibodaux. Pentzien, Inc., has completed a submarine crossing of dual 20-in. lines across the Mississippi River on Texas Gas Transmission's 30-in. system.

California Standard Oil Co. will build a $10-million gas-treating plant in southeastern Alberta, to process gas sold to Trans-Canada Pipe Lines, Ltd. It will be located between Princess and Denhart fields. Completion is to coincide with the Trans-Canada timetable, which calls for the project to be finished by the summer of 1958.

Also for Pipeliners . . .

The question of a state's authority to set a minimum wellhead price for gas apparently is headed for the U. S. Supreme Court again now that the Kansas Supreme Court has upheld a Kansas minimum price (P. 86) . . . Prospects are bright for an early start on a gas system from Texas to Florida (P. 90) . . . California attorney wants an investigation, claims El Paso's purchase of Pacific Northwest will create a monopoly on gas flowing into California (P. 91) . . . FPC's Digby says he would welcome a new gas law; New Mexico's Simms says the outlook for new legislation is bright (P. 100) . . . Lone Star has started injecting gas into the world's deepest and highest-pressure underground storage project . . . Interior Department is looking at new rules for public lands right-of-way easements . . . P.G.&E. files application for line in northern California (P. 102) . . . New York State Natural Gas plans storage project with 100 billion cubic-foot capacity (P. 104).

PLUS THESE TECHNICAL FEATURES: How a new maintenance-welding procedure works on pipelines with pipe-surface temperatures of 50° F. and below (P. 108) . . . and Pipeline Patrol: Zinc anodes still have a place in cathodic protection (P. 155).

Smoking wreckage in the snow tells grim story:

Phillips Officials Die in Crash

BARTLESVILLE. — An air tragedy last week killed eight employes of Phillips Petroleum Co., including five executives in the company's natural-gas department.

A. M. RIPPEL

The eight men were aboard a company plane which crashed in a pasture 5 miles south of Bartlesville shortly after takeoff on a flight to Salt Lake City.

The dead:

... **A. M. Rippel,** 61, manager of the natural-gas department.

... **C. A. Binkley,** 45, chief gas-production engineer.

... **D. F. Mayfield,** 49, staff director of gas valuation and procedures.

... **T. D. Young,** 31, supervisor of gas records and procedures.

... **W. C. Reed,** 37, staff director of gas contracts.

... **George L. Sneed,** 43, company land attorney.

... **Joe Bowers,** 38, pilot.

... **R. E. Ullrich,** 36, copilot.

The crash was the first involving a company plane since Phillips began using aircraft to transport personnel more than 15 years ago.

The company in a statement explained the pilot was attempting to return to the Bartlesville airport when the plane went out of control. It crashed nose first into a pasture on the Redbird ranch of Dick Kane a few yards off U. S. Highway 75.

Witnesses said the plane went into two spins from about 1,200 ft. One motor was smoking as it headed to earth. Intense flames in the cabin made all rescue attempts futile.

Most widely known victim was Rippel, who joined Phillips in 1925. He was a native of Milton, Pa., and a graduate of Bucknell University. He worked as an engineer for Empire Gas & Fuel Co. before joining Phillips.

Binkley, the chief engineer for the natural-gas department, had been a Phillips' employe for 20 years. Mayfield, also a veteran employe, was staff director of gas-property valuation. Young, an Oklahoma A. & M. College graduate, joined Phillips in 1951 after military service in Korea. Sneed joined the Phillips legal staff in 1939 after doing private practice and legal work for Shell in Tulsa.

Texas Flood to Expand

AUSTIN.—Standard Oil Co. of Texas plans to expand a pilot water flood in the Cisco sand in Kelly-Snyder (Cisco) field to a field-wide project.

The company has asked the Texas Railroad Commission to approve the expansion, to exempt the project from shutdown days, and to hike the present 75 bbl. per well MER to the yardstick figure of 111 bbl. daily.

Standard had injected 1,275,588 bbl. of water through eight input wells into the 6,100-ft. pay as of October 1. There are 86 producing wells in the field. The company plans to use an 80-acre, five-spot pattern. The flood eventually will involve 49 input wells and 43 producers.

Standard's J. R. Graham told the commission his company expects to recover an added 3,500,000 to 4,000,000 bbl. of oil due to the flood.

Drilling Deal Brews

Falcon Seaboard may buy six-rig Venezuelan firm

TULSA. — Falcon Seaboard Drilling Co. has an option to buy Drosdat & Dotson Drilling Co. of Venezuela. The purchase would mark Falcon Seaboard's first move into foreign operations as a drilling contractor.

D. & D. has six rigs operating in Eastern Venezuela, five of them under contract to Mene Grande Oil Co., Gulf Oil Corp.'s subsidiary. Three of the rigs are workover and three are drilling. All are Nationals, three of them T-20s, two T-32s, and one 75.

The Venezuelan firm is also a general contractor, with road-building equipment and more than 20 rig haulers. Owned by Werner Drosdat and Frank Dotson, the company operates from headquarters in Anaco.

Falcon Seaboard, which has until March 1 to exercise its option, operates 27 rigs, all in the U. S. Four are in the Denver basin of the Rockies, 13 are in Kansas, Texas, and New Mexico, and 10 are in Louisiana.

The company owns about 1,500 bbl. daily of crude production in Colorado, Kansas, Oklahoma, Texas, and Louisiana. It holds a 7 per cent interest in Bolivian Gulf Oil Co., which is getting ready to drill in Bolivia.

New Memory Monster

PASADENA.—A new electronic filing device with 10 times the memory capacity of any other data-processing unit has been introduced by Electro-Data Division of Burroughs in Pasadena.

Called the Datafile, it comprises a combination of smaller individual units each with a capacity of 20,000,000 characters. As many as 10 of these units may be incorporated into a Datatron electronic computer to give the whole system a memory for 200,000,000 digits. This represents the equivalent of 250,000 punched cards.

Each Datafile uses fifty 250-ft. magnetic tapes which can be run forward or backward. They are scanned by twin heads which can read or write from 1 to 100 blocks of data at the rate of 46 milliseconds a block.

A Dowell engineer will tell you the advantages of Allison aircraft-powered pumpers.

Make fracturing treatments more effective .... with DOWELL auxiliary services

Fracturing treatments to improve oil or gas production often call for more than just sand and a carrying fluid. Special addition agents and auxiliary services can mean the difference between success or failure.

Dowell engineers have at their disposal a wide variety of fracturing aids to solve specific well problems. Here are four of the more important Dowell products and services that help you get even better results from fracturing.

MUD ACID is a mixture of hydrochloric acid and hydrofluoric acids. It dissolves clay minerals and destroys the swelling and colloidal properties of bentonitic materials. As a spearhead, Mud Acid increases fracturing effectiveness by cleaning the formation face.

F. L. A.* (Fluid Loss Additive) is designed to lower the fluid loss of fracturing fluids. F. L. A. helps provide longer fractures and deeper penetration of sand. There are several kinds of F. L. A. to meet various well conditions.

FIXAFRAC* uses a temporary plugging material consisting of solids suspended in a fluid. These solids liquify after a short time and return to the well bore. Fixafrac is used between treatment stages to seal initial fractures or permeability, allowing new fractures to be formed in other sections of the pay zone.

FREFLO* is a mixture of chemicals that acts in three ways to prevent or destroy water block. It reduces surface tension, it partially destroys interfacial tension between water and oil, and it breaks emulsions. In fracturing treatments, Freflo is added to the breakdown and flush oil to prevent emulsions.

For more information or service, call any of the 165 Dowell offices in the United States and Canada; in Venezuela, contact United Oilwell Service. Or write to Dowell Incorporated, Tulsa 1, Oklahoma.

*Trademark of Dowell Incorporated

Services for the oil industry

DOWELL

A SERVICE SUBSIDIARY OF THE DOW CHEMICAL COMPANY

Gas Law Possible

Digby, Simms believe new bill to free gas producers from utility-type control has a good chance of passage in '57

MIAMI BEACH, Fla.—Natural-gas legislation will be enacted by the next Congress if the industry judiciously supports a bill under which all segments can live and which protects consumer interests, the Interstate Oil Compact Commission was told by two speakers at its winter meeting here.

Commissioner S. L. Digby of the Federal Power Commission said the FPC will welcome a new law because it is finding that efficient, utility-type regulation of independent gas producers is a physical impossibility.

The only relief is sensible, reasonable legislation by Congress which will protect the needs of consumers and the national interest as well as recognize the problems of producers, pipelines, and distributors, he said.

Digby urged the industry to work with federal, state, and municipal governments in finding a common ground of understanding. He predicted that if this is done satisfactory legislation can be enacted at an early date.

Outlook brighter . . . Gov. John F. Simms of New Mexico, retiring chairman of the Compact Commission, said the outlook for new legislation is considerably better than at the time of the veto of the Harris-Fulbright bill. He declared:

"It is my hope that remedial legislation will again be placed before Congress, preferably quite early in the session. If the new bill can get the indicated support from the White House, it should stand a good chance for passage.

"I understand that several segments of the industry—the producers, distributors, and pipeliners—have been holding a series of informal meetings to try to work out the basic principles which they feel must be stated and clarified in any compromise bill that is introduced.

"The fourth element which calls for consideration is the interest and protection of the consumer.

"We can't afford 'apparent conflicts.' This entire industry must put up a united front, with any apparent conflicts resolved long before they hit the public print.

"If the natural-gas industry succeeds in obtaining desperately needed relief through enactment of a new gas bill early in 1957, that success is dependent upon the cooperative efforts of all concerned.

"There can be no mistake—not one.

"There can be no Case incidents to smear a reputable industry and evoke wild charges from its enemies and detractors.

"Personally, I think the job can be done. I think that the President, self-admittedly in accord with its basic objectives, will even help.

"This is a time to start all over and rely on a receptive Congress and a President who left the door open.

"This is a time to forget old grudges and grievances, to get rid of any remaining chips on our shoulders, and to be confident that everyone can work together and emerge with an intelligent and workable piece of legislation."

Merger Still On

Suit hasn't killed hopes of Bethlehem and Youngstown

NEW YORK.—Antitrust action against Bethlehem Steel Corp. and Youngstown Sheet & Tube Co. is not stopping merger plans of the two firms.

U. S. Atty Gen. Brownell field suit here last week to block the move. But company officials said they "hope that the legal proceeding will be expedited and the questions involved speedily determined by the courts."

The merger, which sprouted its first roots back in the 1930's, would leave Bethlehem the surviving firm. It would push the company's capacity considerably closer to that of world-leader U. S. Steel Corp., but would not change Bethlehem's position as second largest steel producer.

Eugene G. Grace is chairman of Bethlehem and J. L. Mauthe is chairman of Youngstown. After Atty. Gen. Brownell posed the threat of antitrust action, they issued a joint statement declaring that agreement on final terms of the merger is "not feasible at this time."

But Bethlehem last month proposed a 4-for-1 split of its common stock. The proposal is expected to be made at a meeting of stockholders January 17. Bethlehem stock last week was up about 10 cents a share at $188. Youngstown fell off more than 35 cents a share to around $127.

Three oil-supply firms are involved in the merger. Two of them, Continental Supply Co. and Emsco Manufacturing Co., are scheduled for consolidation on January 1 *(The Oil and Gas Journal, December 3, page 73)*. Both are subsidiaries of Youngstown Sheet & Tube. The third is Bethlehem Supply Co., a Bethlehem Steel subsidiary.

Deal is big one . . . Annual capacity at Bethlehem and Youngstown combined is rated at 25,750,000 tons. This compares with 39,215,000 tons of capacity at U. S. Steel.

Last year, the two merging companies listed combined total assets at $2,113,987,000. U. S. Steel listed $3,348,696,000.

Merger of the two firms was derailed the first time by the depression. Talks were revived after World War II. When the plans were confirmed in mid-1954 by Bethlehem, the Justice Department announced it would oppose them.

The department said the move would reduce competition in the steel industry, but Bethlehem and Youngstown spokesmen argued the two firms are located in different sections of the country and are not competitive.

Bethlehem's plants are in the East and on the Pacific Coast. Youngstown operates through the middle belt of the country.

Indians Woo Oil Industry

BROWNING, Mont.—The Blackfeet Indian tribe is offering free grants of land to oil, gas and other industries willing to locate on its sprawling 1,500,000-acre reservation bordering Montana's Glacier National Park.

There is no acreage limit to the offer. The tribal business council said it will provide as much land as necessary for each single plant to be built.

The council hopes that through the plan work and vocational training will be provided for the tribe members living on the underdeveloped reservation. There are 1,500 employable adults there who do not wish to move to industrial centers under the Indian Bureau's relocation program.

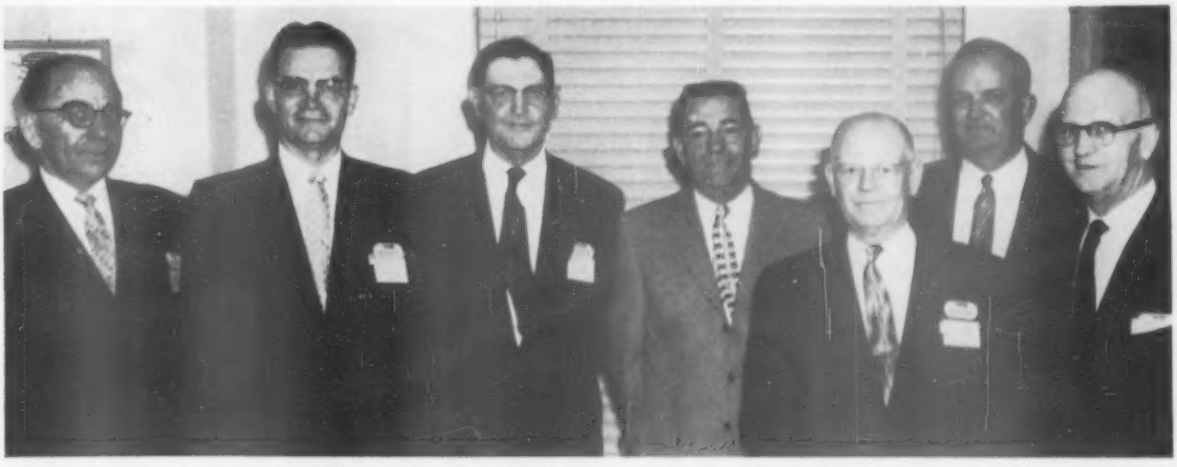
More Tankers for West Coast

WASHINGTON.—West Coast shipyards will more than likely receive more contracts for tanker construction—a result of encouragement from the Maritime Commission.

The commission announced last week that Bethlehem Pacific Coast Steel Corp., San Francisco, will build a 32,650-ton, 17.5-knot tanker for Overseas Navigation Corp.

In return, Overseas will be allowed to transfer four war-built Liberty ships to friendly foreign flags.

The Buildings: Headquarters for far-flung Halliburton operations is this group of buildings on the south edge of Duncan, Okla. Big expansion program has now been completed.



The Men: Top officials at the ceremonies included, left to right: R. M. Hansen, vice president, manufacturing; L. B. Meaders, president; H. P. Conroy, vice president, field operations; R. R. Emery, vice president, foreign operations and export sales; L. D. Campbell, vice chairman; R. O. Brown, vice president and general counsel; and R. G. Kelly, senior vice president.

Halliburton Displays Expanded Plant

DUNCAN, Okla. — Halliburton Oil Well Cementing Co. last week celebrated completion of several large expansion projects with an open house for several thousand people in its headquarters here.

Guests included more than 2,500 Halliburton employes living in Duncan. The company now has more than 9,200 employes in its widespread organization.

One of the biggest recent expansions is that of its technical center, which was increased by half its former size. It now houses 320 people.

The main administration building was greatly expanded and a complete new set of shops built.

Halliburton also has drilled and cased a new experimental test well 2,600 ft. deep. It is equipped to simulate well conditions at depths as great as 25,000 ft.

Need for the new facilities is shown in the fact that Halliburton last year performed 253,950 service jobs—nearly 700 a day and a 7 per cent increase over the previous year.

The original, and still largest, service of the company is cementing. But many others have been added. They now include formation testing, acidizing, electrical well services, tools for specialized functions, and production-improvement techniques, including fracturing.

Since 1940 the company has opened branches or created subsidiaries in 17 foreign countries.

An intensive research program is carried on by Halliburton. Newest developments of the mechanical sections include devices for continuous gelling and proportioning of fracturing fluids; a cementing truck and a wire line truck for permanent well completion work; a retrievable test, treat, and squeeze packer with full tubing opening; a sidewall anchor to allow off-bottom formation testing; and an open hole treating packer for chemical treatments in air-drilled wells.

A substantial contribution of the chemical laboratory has been the discovery of a deep-well cement, Pozmix 140, which contains no portland-type cement. Other work includes improvement of fracturing fluids; development of FL-1, a low fluid loss additive; and discovery of a method for making fracturing sand radioactive.

This new plant injects gas into . . .

World's Deepest Storage Pool

DALLAS.—Lone Star Gas Co. has started storing gas in the world's deepest and highest-pressure underground storage project.

The company is injecting about 13,500,000 cu. ft. daily through four input wells into the Bacon and Rodessa limestone horizons in Tri-Cities field near Athens in Henderson County, East Texas.

First gas was injected November 27. Since then two more input wells have been readied for injection service.

Gas for storage is compressed in the new 4,050-hp. station shown above. It now has three 1,350-hp. compressors, but the company may boost capacity later by supercharging to 5,400 hp.

Lone Star will store up to 30 billion cubic feet in the two zones . . . about 20 billion in the Bacon at 7,800 ft. and 10 billion in the Rodessa at 8,200 ft.

About 10 billion cubic feet of the total capacity will be cushion gas—with native gas accounting for about 3 billion cubic feet of this volume.

Both the Bacon and the Rodessa, discovered in 1941, are now virtually depleted. Bacon pressure is down to about 150 psi., while Rodessa pressure ranges from about 195 psi. to 600 psi.

More liquids, too . . . Lone Star plans to boost pressure of the two zones to the approximate original level of 3,200 psi. About 2 years will be needed to do this.

The big boost of present deflated pressure to the high 3,200-psi. storage-operating level also is expected to net Lone Star large added volumes of oil and condensate from the two zones. Both zones will be cycled during oil-storage and off-withdrawal periods.

Full-scale injection operations probably will get under way at the project next April. The plant then will inject up to 80,000,000 cu. ft. daily of gas from fields in the East Central Texas area.

Four of the project's six input wells will inject into the Bacon, the other two into the Rodessa. Along with the inputs, the two reservoirs have 38 producing wells. Some of these will be plugged, the rest used for withdrawal.

Biggest in Texas . . . Tri-Cities will be the largest underground-storage operation in Texas and second in the Southwest only to Oklahoma Natural Gas Co.'s 87-billion-cubic-foot project in Oklahoma.

It is the fourth Lone Star storage project—all of them launched since 1950.

The other three are in Leeray field, Stephens County; View field, Taylor County; and New York City field, Clay County.

Their capacities range from 3½ billion cubic feet at View field to slightly over 7 billion cubic feet in Leeray. Capacity figures include cushion gas.

Long Beach Pays Off Big Bill

LONG BEACH.—With the transfer of $10,405,708 to the state last week, the city of Long Beach completed payment of tidelands oil funds due California under a compromise agreement reached between the city and the state last April.

Long Beach earlier made an initial payment of $122,339,133 covering monies due from oil and gas revenues up to February 1, 1956. The latest $10,405,000 payment covered the state's share of such revenues from February 1 to October 31, 1956.

These two transactions bring the city up to date in meeting the terms of the agreement. The compromise was reached after several years of litigation and legislative wrangling involving the disputed oil-rich tide lands at Long Beach.

Right-of-way Rules Studied

WASHINGTON.—The Interior Department is working out new regulations on the use of right-of-way easements through public lands.

An amendment written by the Bureau of Land Management would bar private arrangements for right-of-way usage for more than one purpose. The sharing of easements will be permitted, but the second user will be required to get a permit from the Interior Department.

For example, under this rule the holder of a telephone line right-of-way could not enter into arrangement for the inclusion of a gas pipeline on the same easement unless the pipeline company first secured a permit.

Present right-of-way holders would be protected by a provision that any additional easements for use of the same lands shall not interfere unduly with existing rights.

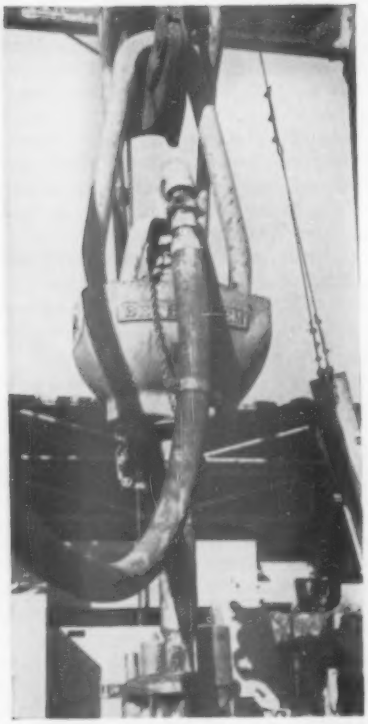
California Gas Line Planned

SAN FRANCISCO.—Pacific Gas & Electric Co. last week filed an application with the California Public Utilities Commission for authority to build a $9,440,000, 173-mile natural-gas pipeline from Sacramento Valley gas fields to Humboldt County in Northern California.

The 12-in. line would pick up and transmit approximately 21,000 M.c.f. daily from the Beehive Bend, Perkins Lake, and Corning gas fields for transmission to the Eureka area near the California-Oregon border.

The Humboldt division of P. G. & E. has been servicing customers with gas from the dwindling Tomkins Hill field in Humboldt County. However, the gas company has had to supplement Tompkins production with about $470,000 in propane gas to meet demand in that region.

Built to Weather the Years



A Bethlehem B-24 was selected for heavy-duty service in this land-based rig.

Above is a brand-new Bethlehem B-line swivel en route to its first drilling job. It's part of a barge-mounted outfit designed for use in the shallow waters of the Gulf Coast region. After it's once put in service and that shiny new paint gets its battle scars, the unit won't be lying around on its back very much.

And even when it's a time-worn veteran of many campaigns, it will still be earning its keep. For Bethlehem B-line swivels are built to last; they're made right, and they run right, and they stay on the job.

One reason is the design and extra sturdiness of the main bearing. In all sizes of these swivels, main bearing capacity is far in excess of drilling load requirements. Parts are so rugged and strong that they wear very slowly and seldom need replacing.

There are other features, too, that are worthy of note in this advanced line of swivels. For instance, to assure adequate lubrication, the units are provided with oversized oil reservoirs. And they are equipped with Bethlehem's double-life washpipe, which can be locked at either top or bottom to provide twice as much life as in swivels equipped with a single stuffing box.

B-line swivels are available in four different sizes as shown in the table. Each is a master in its drilling range. We'll gladly furnish full details if you'll call or write.

A Size for Every Drilling Depth

No.	Main bearing cap., 100 rpm API rating method
B-11	75 tons
B-15	150 tons
B-18	235 tons
B-24	435 tons

BETHLEHEM SUPPLY COMPANY
General Offices: 21 E. Second St., Tulsa, Okla.
West Coast Headquarters: Los Angeles, Calif.
Export Distributor: Bethlehem Steel Export Corporation
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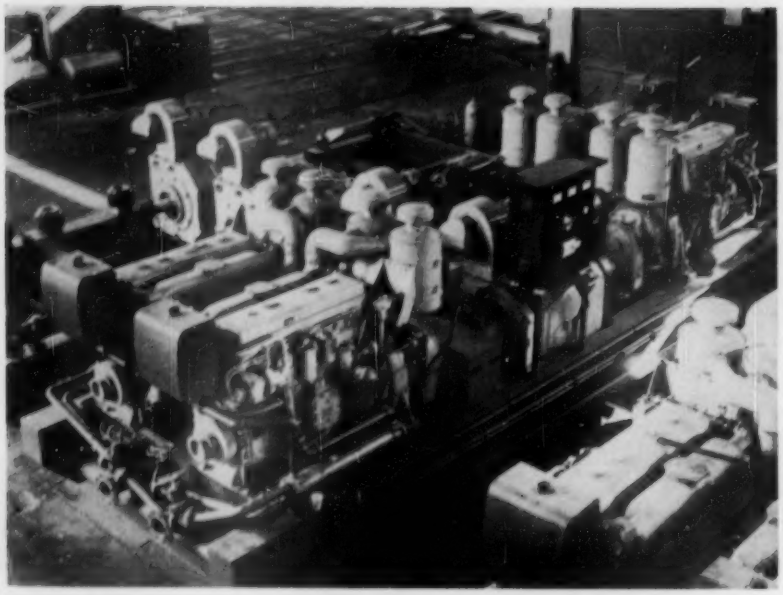
BETHLEHEM STEEL

BETHLEHEM SUPPLY



These generators will make Mr. Gus II the . . .

. . . Most Powerful Rig Afloat

HOUSTON.—The most powerful diesel-electric drilling plant ever used on an offshore drilling rig will be placed aboard "Mr. Gus II," the mammoth mobile drilling platform now under construction for C. G. Glasscock Drilling Co.

A unit with a maximum rating of 6,000 hp. will drive the drilling equipment. Additional units for auxiliary services will exceed 1,500 hp.

The power plant is being assembled in Houston by Stewart & Stevenson Services, Inc. The mobile platform, capable of operations in water approximately 140 ft. deep, is being constructed at Bethlehem Shipyard, Beaumont. It is scheduled to go into service about February or March.

The equipment . . . Primary power unit for "Mr. Gus II" will consist of five Stewart & Stevenson Model S24-1000 Rigelectric power packages.

Each is composed of two 600-hp. d.c. generators and four Model 6-110 General Motors Detroit diesel engines.

Design will permit all four engines to supply power to both generators of each unit, or a lesser number of engines may supply the power through either of the two generators.

Drilling equipment to be powered by the Rigelectric units will consist principally of a National 160 draw works, three National G-1000 mud pumps, rotary table, and coring reel.

The draw works will be driven by three d.c. electric motors with a combined capacity for hoisting service of 2,700 hp. Power for each of the mud pumps will come from dual d.c. electric motor drives with a combined capacity for continuous-duty service of 1,200 hp. The independent rotary table and coring reel will be driven by an individual d.c. motor.

Three 300-hp. diesel generator sets will provide a.c. electric power for auxiliary service and lighting.

Larger brother . . . "Mr. Gus II," a triple-deck platform, is an enlarged version of the original "Mr. Gus," which was designed to operate in 100-ft. water. The earlier unit has been in operation nearly 2 years.

Its power plant is rated at about 2,000 hp. less than that on the new platform.

Big Storage Project Planned

PITTSBURGH, Pa. — New York State Natural Gas Co. plans to build underground gas storage facilities in north-central Pennsylvania, with an ultimate capacity of more than 100 billion cubic feet.

This would be one of the largest single storage facilities for natural gas in the United States, and one of 58 gas storage fields in Pennsylvania.

Costing an estimated $25,000,000 to build, the project comprises land in Cameron, Potter, and Clinton counties, north of Renovo. It will include a portion of Leidy gas field, which is nearly depleted, and Greenlick gas field.

Fenton H. Finn, president of the gas firm, said an additional $10,000,000 will be invested for purchase of a gas cushion in the reservoir. The area is covered by a 40-year lease with the State of Pennsylvania.

The project will require until 1959 to complete.

New Deal on Imports

When normalcy returns, all but Canada must comply

WASHINGTON. — The Government will call for a new deal on imports control when Middle East oil again becomes available to this country. All exceptions from the standards set by the Cabinet fuels committee last year will be wiped out, except that on Canadian oil.

Officials predicted that Mobilization Director Flemming will revert to the basic principles of the Cabinet committee's report.

They said he will insist that all imports, including those into the West Coast area, excepting only those from Canada, must be kept within the 1954 ratio to domestic crude production.

Analysis of the 1957 programs filed by the importing companies with the ODM last month showed that imports next year would have threatened national security. This included those into District 5 as well as those from Venezuela.

It will probably be some months before the imports question is revived. But one high official said the pattern of distribution of Middle East oil then may be far different.

Upheavals like that created by the closing of the Suez Canal and the cutting of the Iraq pipeline are almost bound to change the imports picture, he said.

I.R.A.A. worried . . . In the meantime, the Independent Refiners Association of America has expressed concern over the prospect of higher domestic-crude prices resulting from the emergency relief program for Europe.

The organization, in letters to Flemming and Interior Secretary Seaton last week, said if Europe is supplied almost exclusively with crude, oil prices will rise and refiners, already facing heavy stocks of gasoline, will be squeezed.

The two officials were reminded: "The Government assumes a high responsibility to see that the basic economy of the nation is not more adversely affected than need be."

Brazil Bets Big on Oil

● Production, refinery facilities being expanded fast and a petrochemical industry sprouts from new plants

BRAZIL will achieve self-sufficiency in petroleum products by 1960 if it holds to scheduled refinery expansion over the next 4 years.

The nation also has the beginnings of a petrochemical industry in several new projects coming up.

These plans for the future were outlined last week before the American Institute of Chemical Engineers by F. C. Williams and A. S. Moggi. Both are executives of Petrobras, Brazil's state-owned oil industry.

Brazil already is showing progress in balancing its petroleum trade.

Last year petroleum products worth $290 million were consumed in the country. Of this, $257 million worth were imported. This year Brazil's total consumption of products will total $318 million. Imports will represent $267 million of this.

The Petrobras' officials said more and more of the requirements will be met from domestic sources as a refinery-building program progresses.

What's planned . . . A new 90,000-bbl. daily refinery will be built at Rio de Janeiro. Others are scheduled at Corumba and Belem.

Increases totaling about 80,000 bbl. daily also are planned for existing refineries, principally in the south around Sao Paulo.

In all, the 4-year petroleum plan includes these goals:

. . . **Increased exploration** and crude production.

. . . **Expanded refinery capacity** to 330,000 bbl. daily to match internal consumption.

. . . **Creation** of the Brazilian Petroleum Institute.

. . . **Tanker fleet expansion** from present 200,000 tons to 400,000 tons.

Williams and Moggi said some production gains already were being made. They cited the record of Bahia field. Production there has risen from 7,000 bbl. daily to 21,000 bbl. daily. They estimate withdrawals will reach 40,000 bbl. daily next year.

Petrochemical outlook . . . Petrobras does not plan to create a monopoly in petrochemicals, the executives declared.

Instead, the state-owned oil and refining combine will produce only basic chemicals for sale to private industry for conversion to finished chemicals, fibers, resins and elastomers.

A 100-ton per day synthetic ammonia plant is now building at Cubatao and will be on stream early in 1957. This plant will produce 340 tons per day of fertilizer to help balance Brazil's needs because of rising agricultural demands.

The plant will produce 1,000,000 cu. ft. of hydrogen per day. While most of it is slated to go into ammonia production, some may be returned to the adjacent refinery for hydrogen treating of petroleum fractions. Other hydrogen and carbon monoxide from the Texaco-licensed synthesis gas process later may be utilized for methanol and formaldehyde manufacture.

Other projects . . . A second project at the Cubatao refinery is an ethylene recovery unit.

The refinery presently makes about 20 tons per day. But capacity of the recovery plant is set for 60 tons to handle future production from an ethane pyrolysis unit. Of the original plant output, 5 tons per day will go to a styrene plant being built by the Koppers Co. Union Carbide's Brazilian subsidiary will take 10 to 14 more tons for polyethylene manufacture. Roughly the same amount is to be earmarked in the future for chlorination to make insecticides and industrial chemicals by Electrochloro, S.A.

Petrobras also will install fractionation facilities for propane and propylene. Propane will be marketed as L.P.G. Rodia do Brazil plans to convert the propylene to alcohols and ketones for domestic consumption.

Still more chemicals are due to come out of the Cubatao refinery. Two companies, Organoquimics Braziliera and Copebras (Celanese and Columbian Carbon) plan to operate carbon black plants based on residual fractions from the refinery. Their output is slated to total 20,000 tons of carbon black per year.

Several companies have shown an interest in acquiring benzene from the Cubatao refinery. But Petrobras will wait until the catalytic reforming unit planned for the new Rio refinery is completed before considering aromatics separation. The Rio refinery will become the hub of another petrochemical complex if Petrobras' plans materialize for separation of butane, butylenes, propane, propylene, ethane and ethylene.

Strangely enough, said Williams and Moggi, Brazil since 1952 has needed more rubber than the Amazon area can produce. Between 30,000 and 40,000 tons of synthetic rubber will be needed in 1960. These requirements will be provided by a butadiene and rubber facility to be built at Rio.

Refinery to Expand

Added capacity pegged to Baghdad's growing needs

THE biggest refinery in Iraq will double in size within the next 30 months.

Bids will close April 1 on construction that will boost capacity of the Government's 24,000-bbl. Daura refinery at Baghdad to 50,000 bbl. daily. The plant is owned and operated by the Government Oil Refineries Administration.

J. W. Mitchell, general superintendent of the refinery, said contracts will be let about June 1. The expansion will take from 18 months to 2 years to complete and will cost between $10 and $12 million. Contractors from several countries are studying tenders on the job.

The plant . . . The expansion will be the second since the refinery went on stream in June 1955.

A 500-bbl. lube plant is scheduled to be completed in May or June. Mitchell revealed plans for the expansion while in Tulsa to interview engineers and technicians to serve as supervisors in the lube plant. Once the lube plant goes on stream, employment will be increased from 14,000 to 25,000 workers. About 60 supervisors will be added.

Mitchell said the refinery currently is operating at 29,000 bbl. daily, 5,000 bbl. above its rated throughput. The refinery is supplied by royalty crude from an Iraq Petroleum Co. line running south to the refinery from Kirkuk field *(The Oil and Gas Journal, December 12, 1955, page 80).*

The refinery's output is consumed locally. Mitchell said the plant will start turning out two grades of gasoline once a proposed cat reformer is completed. Currently it markets one grade with an octane rating of about 80.

Outside Daura refinery, the only other refining facilities in Iraq are several small topping plants.

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Yankee Ingenuity Hits Jackpot

A LITTLE Yankee ingenuity saved at least $20,000 in the construction of Richmond Exploration Co.'s new asphalt refinery at Bajo Grande near Maracaibo, Venezuela.

Faced with the problem of lifting a 62-ton vacuum distillation tower 63 ft. tall, and a 25-ton atmospheric distillation tower 71 ft. tall, the contractor and engineers for Standard Oil Co. of California subsidiary found they didn't have the necessary equipment on hand.

The contractor, Compania Anonima Venezolano Lummus, had the equipment, but it was all in the United States. And it would have cost more than $20,000 to move it to Venezuela.

There were at least three large mobile cranes in Venezuela capable of lifting the towers, but none of the three was available to do the job.

At this point Richmond Exploration's production people came to the rescue of the refinery builders. They suggested that the job might be done with two of their Ideco workover rigs.

The workover rigs had plenty of hook or lifting capacity, but the masts aren't designed to take the lateral loads normally encountered in raising towers like these. By the time the two were reinforced and guyed and fitted with "marriage struts" for rigidity, the portable rigs did the job easily.

Sahara Petroleum Resumes Drilling in Egypt

SAHARA PETROLEUM CO. drilling crews last week resumed operations on two of three desert wildcats the company is drilling in the isolated western desert of Egypt.

Sahara, owned by four big American oil companies, had three rigs operating in Egypt when the British-French-Israeli forces invaded the country. The company evacuated all its personnel except Egyptian employes.

Millard Neptune, president of Sahara, reentered the country a short time ago with two key members of the company. Last week another dozen men went back to start work on two of the rigs.

These were at Gib Afia, which was drilling at 5,561 ft. in late October when the operation was abandoned, and at Beti, the Qattara depression well which was at 7,280 ft. when the crews left the country.

The third well, Mersa Matruh, had been drilled to a total depth of 10,364 ft. Crews were engaged in a fishing job at about 6,600 ft. when hostilities started.

Sahara, formerly Egyptian-American Oil Co., is owned by Continental Oil Co., Cities Service Co., Ohio Oil Co., and Richfield Oil Corp.

The firm has drilled two dry holes in Egypt since it began operations there. One near Alexandria was abandoned at 13,300 ft. and the other, between Alexandria and Cairo, was dry at 13,348 ft.

Venezuela Prices Up

Heavy Maracaibo oil rises for second time in a month

PRICES of heavy Maracaibo crude have advanced for the second time in less than a month.

Cia. Shell de Venezuela, which initiated last month's increase, announced the new higher prices. The combination of the two increases raised quotations from 10 cents a barrel on 22.0°-22.4°-gravity Cabimas crude to 31 cents a barrel on 12.5°-12.9°-gravity Bolivar district heavy crude loaded at lake ports.

The following crudes were advanced 5 cents per barrel in the latest step: Cabimas, 22.0°-22.4° gravity, f.o.b. Cardon, to $2.25; Cabimas, 22.0°-22.4° gravity, f.o.b. Cabimas Jetty, $2.17; and Cabimas, 20.0°-20.4° gravity, f.o.b. Las Piedras, $2.15.

Ten-cent advances were posted for Taparito, 15.5°-16.9° gravity, f.o.b. Las Piedras, to $2.05; Bachaquero, 14.5°-14.9° gravity, f.o.b. Las Piedras, to $2.01; and Bolivar district heavy, 12.5°-12.9° gravity, to $1.95, f.o.b. Cardon, $1.92 f.o.b. Cabimas Deepwater Mooring or Bachaquero, and $1.87 f.o.b. Lagunillas.

Union Oil Signs Cuban Deal

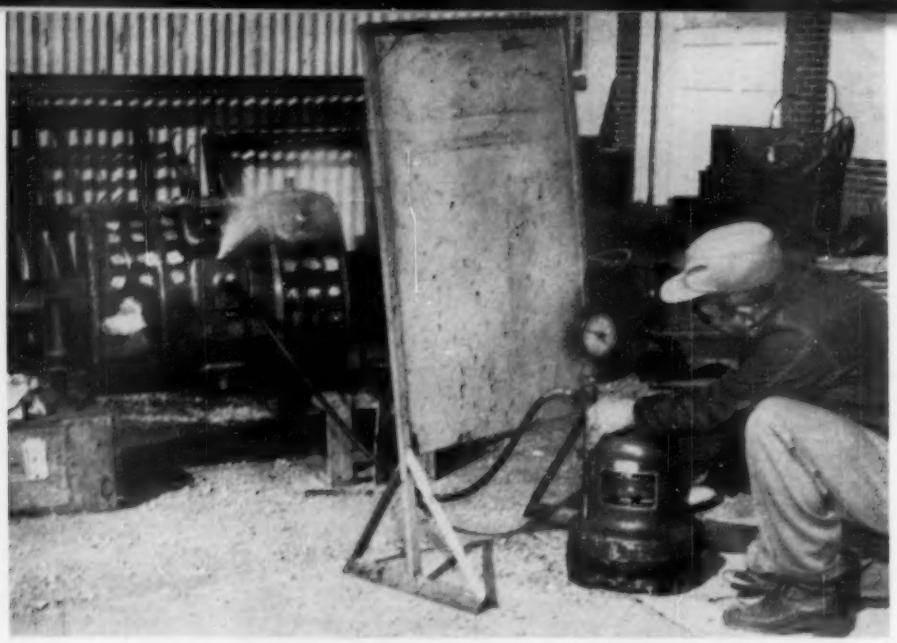
Reiter-Foster Oil Corp. of New York and Union Oil Corp. of California have signed a final operating agreement for exploration and development of more than 900,000 acres of oil concessions in Cuba.

In return for a 50 per cent interest in Reiter-Foster's Cuban holdings, Union Oil will conduct the operations. It already has announced plans to drill two wildcats.

Reiter-Foster retains a 2½ per cent overriding royalty interest in all oil and gas production. Under the contract, each party has the right to acquire one-half interest in any additional Cuban properties obtained by the other.

Union will bear expenses of all geological surveys and research for 3 years, and will acquire consulting services of Reiter-Foster's chief geologist, Addison L. Hayner, for 1 year.

Contract was signed by C. E. Denton, executive head of Union's New York office, and Emil V. Hegyi, president of Reiter-Foster, on behalf of its wholly owned Cuban subsidiary Cuban Oil "RFO," S.A.



LIQUID LEAKING from crack in fusion zone of weld and patch. Fig. 1.

Service Pipe Line researchers believe they've found answers to the question:

What Causes Underbead Cracks in Welds?

. . . and they've instituted a new program in maintenance-welding high-test pipe

by A. M. Hill and F. W. Zilm

SERVICE PIPE LINE CO. has developed a new maintenance-welding procedure for use on pipelines where the pipe surface temperature is below 50° F. Hydrostatic tests proved that fittings which completely encircle the pipe wall will consistently withstand higher internal pressures than the reinforced saddle type of fittings.

The new procedure outlines methods and materials to be used on pipe manufactured in accordance with A.P.I. Specifications 5L and 5LX in Grades B, X42, X46, and X52.

The Service tests showed that the common method of repairing corrosion pits of common grades of 5L pipe (filling the pits with weld metal fused to the surface of the pipe, or by welding patches over the pits) should be restricted to the low and medium-carbon grades of pipe.

Test procedures . . . The tests made to establish the new method were carried out in Service Pipe Line Co.'s Tulsa shops. The aim was to find a solution to the problem of underbead cracking of arc welds where branch connections and reinforcing sleeves are attached to the pipeline by welding.

In these tests the welding was performed under conditions simulating as nearly as possible those encountered in the field. The tests consisted of making spot welds and welding various size patches and full encirclement sleeves on chambers fabricated from 24-in. o.d. pipe manufactured in accordance with A.P.I. Specifications 5L and 5LX.

All welding was done on test chambers cooled with a mixture of water, antifreeze, ice, and salt. The brine was circulated by a pump during the welding operation. After welding was completed on the various chambers, the welds were inspected for underbead cracks either with magnetic particles, or by sectioning 100 per cent of the weld into coupons which were broken in the weld zone to expose the root bead. Several chambers were subjected to destructive tests by hydrostatic pressure.

To simulate field conditions, an internal pressure of 500 psi. was maintained in the larger chambers during the time the patches and sleeves were welded. The chambers which were tested to destruction with hydrostatic pressure were constructed so that the pressure in the chamber was exerted in the space between the sleeve or patch and the chamber wall.

The destruction test on some of the chambers was conducted while the assembly was cooled to approximately 32° F. Materials used in tests are described in Table 1.

Results of Tests

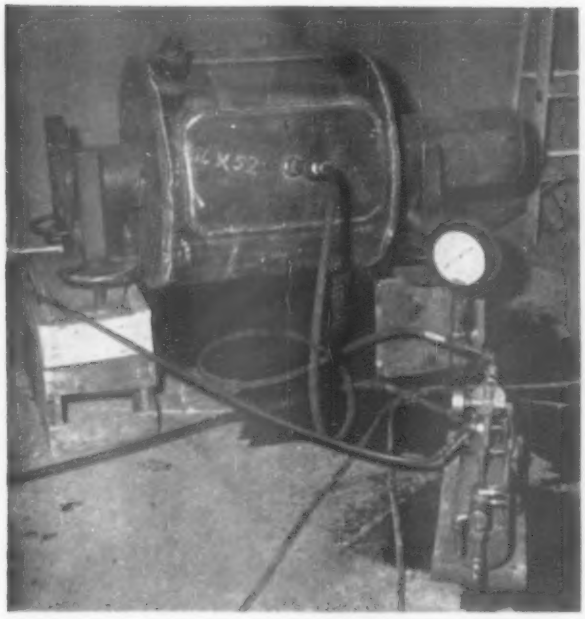
The results of the tests show that the high-yield-strength pipe is very sensitive to the quenching effect of the liquid contained in the test chambers. Underbead cracking occurred in all except one test specimen made with E6010 and E7010 electrodes.

These are the types of electrodes used for field-welding pipe joints and normal maintenance welding on lines laid with Grade B pipe. There was also a pronounced increase in the hardness of the pipe material in the heat-affected zone.

Tests 1, 2, 3, and 4 revealed that underbead cracking occurred in the fusion zone between the weld beads

Authors are with Service Pipe Line Co., Tulsa. Paper presented at 1956 A.S.M.E. Petroleum-Mechanical Conference, Dallas.

PIPELINING



PATCHES WELDED to a chamber, preparatory to testing. Fig. 2.

TEST CHAMBER ruptured beneath patch. Note escaping liquid. Fig. 3.

TABLE 1—MATERIALS USED IN TESTS

Carrier pipe (test chambers):
A.P.I. 5LX Grade X52 pipe 24-in. o.d., 0.312-in. wall thickness.

Chemical analysis of carrier pipe (per cent):

	Ladle	Check 1	Check 2
Carbon	0.270	0.300	0.290
Manganese	1.210	1.250	1.110
Phosphorus	0.020	0.018	0.018
Sulfur	0.030	0.035	0.036
Carbon equivalent	0.573	0.613	0.568

Physical properties of carrier pipe:

Yield strength, psi.	60,620
Tensile strength, psi.	89,890
Per cent elongation in 2 in.	27.5

Patches and sleeves:*
A.P.I. Grade "B" pipe 24-in. o.d. 0.500-in. wall thickness.
A.P.I. Grade "B" pipe 24-in. o.d. 0.312-in. wall thickness.
A.P.I. 5LX Grade X52 pipe 24-in. o.d. 0.500-in. wall thickness.
A.P.I. 5LX Grade X52 pipe 24-in. o.d. 0.312-in. wall thickness.

Welding electrodes:
A.W.S. E6010 5/32-in. diameter.
A.W.S. E7010 5/32-in. diameter.
A.W.S. E9010 5/32-in. diameter.
A.W.S. E7016 5/32-in. diameter (low hydrogen conventional).
A.W.S. E7016 5/32-in. and ⅛-in. diameter (low hydrogen iron powder).

Cooling medium:
Crushed ice, water, alcohol-base antifreeze, and rock salt.
(It was necessary to add antifreeze to the brine to keep the circulating system from freezing.)

*The corners of all patches were cut on a radius.

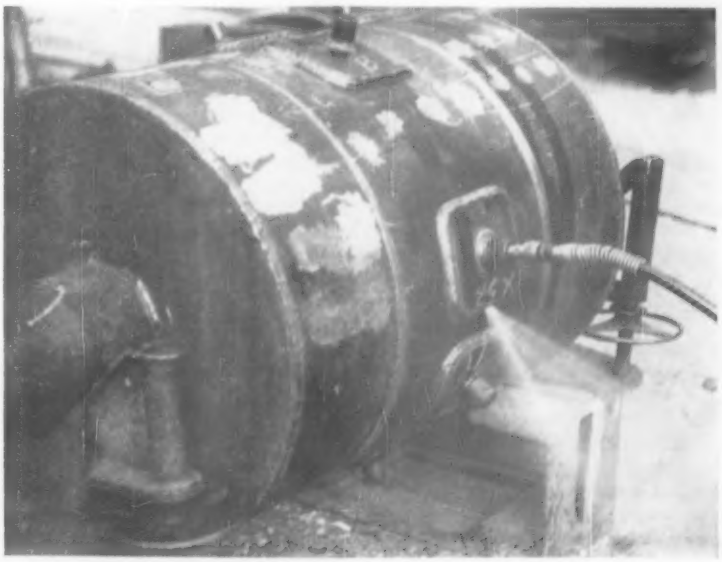
and the base metal on welds made with E6010, E7010, and E9010 electrodes. These types of electrodes are unsatisfactory for use when welding is required on a pipeline (full of liquid under pressure) laid of pipe manufactured in accordance with A.P.I. Specification 5LX, Grades X46 and X52.

Tests 5 and 10 revealed that welds consistently free of underbead cracks can be obtained with E7016 low-hydrogen electrodes, both conventional and iron-powder type.

Tests 6 and 7 revealed that a repair patch or a branch connection saddle-welded onto high-test pipe tends to reduce the ultimate strength of the pipe due to concentrations of stresses in the fusion line of the weld that is parallel to the axis of the pipe.

Tests 8 and 9 revealed that high-test pipe is not suitable for fabricated piping systems such as manifolds, pump headers, etc., unless close control of preheating and interpass temperature is maintained.

Test 11 revealed that E6010 and E7010 electrodes are not satisfactory for welding on pipelines full of liquid which are laid of pipe manufactured



HYDROSTATIC PRESSURE is applied to patch on test chamber. Fig. 4.

FAILURE IN FUSION ZONE between weld and patch on test chamber. Fig. 5.

FAILURE IN TEST CHAMBER adjacent to 16 by 18-in. patch. Fig. 6.

in accordance with A.P.I. Specification 5L Grade B at temperatures as low as 25° F.

Tests 12 and 13 revealed that dye-penetrant material would be a satisfactory method for inspecting welds made on pipelines full of liquid under pressure.

E7016 electrode . . . Although satisfactory results were obtained using both the conventional E7016 low-hydrogen electrodes, and the E7016 low hydrogen-iron powder electrodes, it was found that the latter kind had many advantages over the conventional low-hydrogen electrodes. The advantages are:

1. **Deposition rate.** Using ⅛-in. diameter iron-powder electrodes the deposition rate per linear inch of weld is equal to that of the size 5/32-in.-diameter conventional low-hydrogen electrodes.

2. **Less operator fatigue.** The iron-powder electrodes can be used in all positions without oscillating. This gives the operator better control of the weld puddle and results in a deposit of weld metal having a smooth surface and contour.

The fluidity of the molten metal of the conventional low-hydrogen electrodes requires close observance and controlled manipulation of the electrode by the welder when welding in the overhead and vertical positions.

The fluidity of the weld puddle and the necessity of manipulating the electrode result in a weld bead having a very uneven surface. Undercutting of the base material adjacent to the weld bead is also a problem.

3. **Ease of cleaning.** The beads of weld metal deposited with the iron-powder electrodes have a smooth contour that facilitates slag removal. With conventional low-hydrogen electrodes it was necessary to use hammers and chisels to remove slag from the rough surface of the weld beads, especially at places where undercutting occurred.

Slag remaining on or adjacent to a weld increased the difficulty of handling the molten metal when depositing additional beads.

4. **Inspection.** The tendency of the slag to adhere tightly to the weld metal deposited with the conventional electrodes can hide porosity and undercutting in or adjacent to the welding bead.

5. **Elimination of porosity.** Porosity in the weld metal was a problem with the conventional low-hydrogen electrodes, particularly when restarting the arc after changing electrodes. Depositing more weld metal over such areas tends to increase porosity rather than remove it. This trouble did not occur when the iron-powder electrodes were used.

Description of Tests

In test No. 1 . . . Patches made from Grade B 0.312-in. wall pipe were welded on a Grade X52 pipe chamber filled with water at a temperature of approximately 50° F. One patch each was welded with E6010, E7010, E9010, and E7016 electrodes.

Upon completion of welding, hydrostatic pressure was applied to the area between the patch and the test chamber. Fig. 1 shows this test and testing equipment. In all cases the failure occurred in the fusion zone between the weld metal and the patch.

Test No. 2 . . . Identical to Test 1 except that Grade X52 material was used for the patches, Fig. 2. In this test failure occurred at the fusion zone between the weld and the pipe on all patches with the exception of those welded with E7016 electrodes. In this case, the test chambers ruptured underneath the patch, Fig. 3.

Test No. 3 . . . In this test a chamber, having various size holes drilled partially through the wall of the pipe, was filled with water and temperature was reduced to 50° F. The drilled holes were spot-welded to simulate the repair of corrosion pits on a pipeline. Several patches were welded to the chamber to simulate conventional repair work, using various types of electrodes.

In addition, several weld beads were deposited on the surface of the test chamber. The beads were of both single and multiple-pass layers. The weld beads were ground flush with the surface of the pipe and examined for cracks by magnetic-particle inspection.

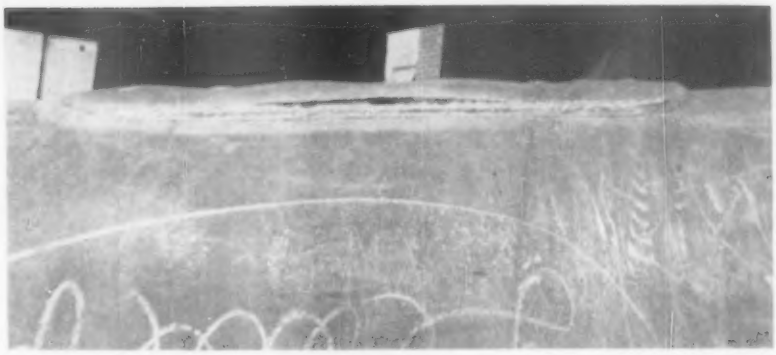
The patches were tested with hydrostatic pressure applied to the area between the patch and the test chamber, Fig. 4. This inspection revealed underbead cracking of all beads deposited with E6010 and E7010 electrodes. No underbead cracking occurred in the weld metal deposited with E7016 and E9010 electrodes.

Test No. 4 . . . This test chamber was cooled to approximately 30° F. Patches and pit holes similar to those in Test 3 were welded, using E9010 and E7016 electrodes.

Hydrostatic tests, physical, and magnetic-particle inspection of the welds revealed underbead cracking occurred where weld metal was deposited with E9010 electrodes. No underbead cracking occurred where weld metal was deposited with E7016 electrodes.

Test No. 5 . . . Full encirclement sleeves made of Grade B pipe were welded to a test chamber cooled to 32° F. E7016 electrodes were used for all welding in this test. There was quite a bit of frost on the surface of the test chamber prior to installing sleeve.

The entire length of both the circumferential and longitudinal welds were sectioned and examined by making a reverse bend of the sleeve sections in relation to the surface of the test chamber. With the exception of some minor



FUSION FAILURE which occurred in fusion zone of weld and 12 by 24-in. patch. Fig. 7.

WELD FAILURE in Test 8. First two beads which cracked as weld was completed are the dark areas adjacent to inner wall of cap. Fig. 8.

cracks at the area where tack welds were deposited, no other evidence of underbead cracking was found.

Test No. 6 . . . One 24 by 12-in. and one 48 by 16-in. patch made from Grade B pipe, were welded to a Grade X52 pipe chamber which was cooled to 32° F. and pressured to 500 psi. Upon completion of welding, pressure in the chamber was increased to 1,450 psi. when failure occurred in the fusion zone between the 48 by 16-in. patch and the weld, Fig. 5.

The hole in the test chamber which allowed the pressure to equalize between the chamber and the patch, was plugged by welding, and the chamber was again pressurized. During the second pressure test, failure occurred at 1,500 psi. in the test chamber adjacent to the weld at the edge of the 48-in. patch.

In this failure the pipe ruptured parallel to the long side of the patch. The rupture was approximately 39 in. long, and tore circumferentially around the test chamber for 6 in. at each end. Fig. 6.

Test No. 7 . . . The section of pipe which ruptured in Test 6 was removed and a new section of pipe inserted in its place to maintain the original length of the test chamber. Hydrostatic pressure was again applied. Pressure of 2,000 psi. was obtained when a failure occurred in the fusion zone between the weld and the edge of the 24 by 12-in patch, Fig. 7.

Test No. 8 . . . A full-encirclement sleeve made from Grade B pipe, 0.500-in. wall, 24 in. in length, was installed and welded with E7016 electrodes onto a 20-ft. Grade X52 pipe chamber cooled to 32° F. A pressure of 500 psi. was maintained in the chamber during the welding operation. Upon completion of welding, and while the chamber was still cool, the pressure was increased to determine the maximum amount of pressure which a repair sleeve of this type would withstand.

When a pressure of 1,500 psi. was reached failure occurred in the weld adjoining one of the weld caps to the pipe. The sudden release of water pressure blew the weld cap 75 ft. Simultaneously, the shock wave of the water and ice contained in the chamber caused failure in the weld adjoining the other weld cap to the opposite end of the pipe.

Procedure used in making these welds was as follows: The root beads were deposited with 5/32-in.-diameter E6010 electrodes. The second bead (hot pass) was applied immediately using 5/32-in.-diameter E7010 electrodes. The remaining beads were deposited by the submerged-arc process.

No preheating was used as the ambient temperature was about 80° F. In determining the cause of these failures, we reconstructed the order in which the welds were made. The second weld that failed was completed first. By close inspection of the cross-section of the weld metal it was found that the root and second beads in an 18-in. segment of weld had cracked. The remainder of the weld was of good quality.

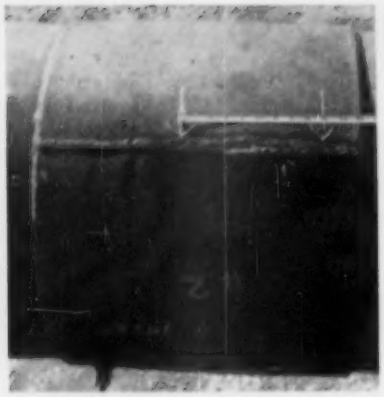
It is evident that the heat input to the base material, after deposition of the root and second beads, had not dissipated beyond the critical range (for the greater portion of the weld length) before the submerged arc was applied to deposit the third bead. By close examination of the other weld, it was found that the root and second beads had cracked throughout their entire length, Fig. 8.

This weld was the last to be completed on the test chamber. It is logical to assume that the heat input of the submerged arc would induce an expanding force sufficient to crack the root and second beads after the base material had cooled to the critical point. This is substantiated by similar welding difficulties which have been encountered in constructing lines laid with X52 pipe.

In many instances (after the pipe had cooled to ambient temperatures) the root and second beads have cracked soon after the welder starts the third bead. This trouble is more likely to occur when the welding crew begins welding at the start of the day, with atmospheric temperatures below 50° F.

Test No. 9 . . . The weld metal which remained on the weld caps and pipe in Test 8 was machined off and new bevels made. The weld caps were then replaced on the pipe and welded by preheating the weld areas to approximately 350° F. The weld caps were then welded to the pipe using E6010 electrodes for the root pass and E7010 electrodes for the remaining passes.

These welds were inspected by radiography and no defects were located. The chamber was refilled with liquid and hydrostatic pressure was again applied. When a pressure of 2,200 psi. was reached a failure occurred in the



HIGH-PRESSURE FAILURE which occurred at 2,200 psi. in the longitudinal seam of sleeve in Test 9. Fig. 9.

UNDERBEAD CRACK between weld and patch which occurred in the fusion zone before weld was completed. Fig. 10.

longitudinal weld of the encirclement sleeve, Fig. 9.

Higher pressures could have been attained had the assembly been so designed to permit 100 per cent penetration of the weld metal at this point. The lack of penetration was deliberate, in that we did not think it advisable to fuse or penetrate the chamber with a welded seam parallel to the axis of the pipe.

Test No. 10 . . . This test was conducted to determine the handling characteristics, and whether or not we could obtain welds free of underbead cracks using E7016 low hydrogen-iron powder electrodes. (These electrodes were not available when this testing program was started).

Various size patches and full-encirclement sleeves made of Grade X52 0.312-in.-wall pipe were welded, using these electrodes, to test chambers made of the same material, which were cooled to 25° F. Physical tests conducted on the entire length of the weld metal deposited revealed that no underbead cracking had occurred.

Test No. 11 . . . To determine the effects of maintenance welding on pipe lines laid or pipe conforming to A.P.I. 5L Grade B, carrying liquid at temperatures below freezing, various size patches cut from this grade material were welded to chambers of the same material. These chambers were cooled to a temperature of 25° F. and this temperature was maintained during welding.

Both E6010 and E7010 electrodes were used. These welds were examined for underbead cracking by sectioning the entire length of the weld and making reverse bends in the weld area of each section. Underbead cracking was found at two locations under the weld on a 16 by 33-in. patch. One crack was about 1¾ in. in length, and the other was ⅝ in. in length.

Test No. 12 . . . This test was conducted to determine the most practical nondestructive method of inspecting welds (for underbead cracking) made on pipe lines full of liquid under pressure. Patches cut from Grade X52 pipe were welded to a Grade X52 pipe chamber cooled to 25° F. Welding was done with E6010 and E7010 electrodes. Experience gained in our first tests revealed that cracking definitely would occur under these conditions.

On some of these patches, cracking occurred in the fusion zone between the weld metal and the patch before the welds were completed, Fig. 10. These cracks were visible to the naked eye. On completed welds where cracks were not visible to the naked eye, dye-penetrant material was used as an inspection medium.

UNDERBEAD CRACKS located with dye-penetrant material. Fig. 11.

This inspection exposed several cracks in the fusion zone between the weld metal and the patch, also between the weld metal and the chamber, Fig. 11.

Test No. 13 . . . To determine whether dye-penetrant material if used for weld inspection would consistently expose underbead cracks, two size 16 by 33-in. patches cut from Grade B pipe were welded to a Grade X52 pipe chamber cooled to 25° F. Size ⅛-in. low hydrogen-iron powder electrodes were used for welding in this test.

The welds were inspected by dye-penetrant material. This inspection revealed that no cracking had occurred. The entire length of the weld was then sectioned and examined by making reverse bends of the sections. No cracks were found in the test.

Recommendations

As a result of our findings, we have recommended that our company adopt the following procedure for repair and maintenance welding on pipe lines that contain oil or petroleum products.

1. A.P.I. 5LX Pipe, Grades X46 and X52

(a) Use fittings that completely encircle the pipe. This holds true regardless of pipe size, when welding is required for making repairs, or for installing new connections onto a line.

(b) Use E7016 low hydrogen-iron powder electrodes for all welds which are fused to the wall of the pipe.

2. A.P.I. 5L Grade B and 5LX Grade X42

(a) Use fittings that completely encircle the pipe when welding is required for making repairs, or for installing new connections on pipe 12¾-in. o.d. and above.

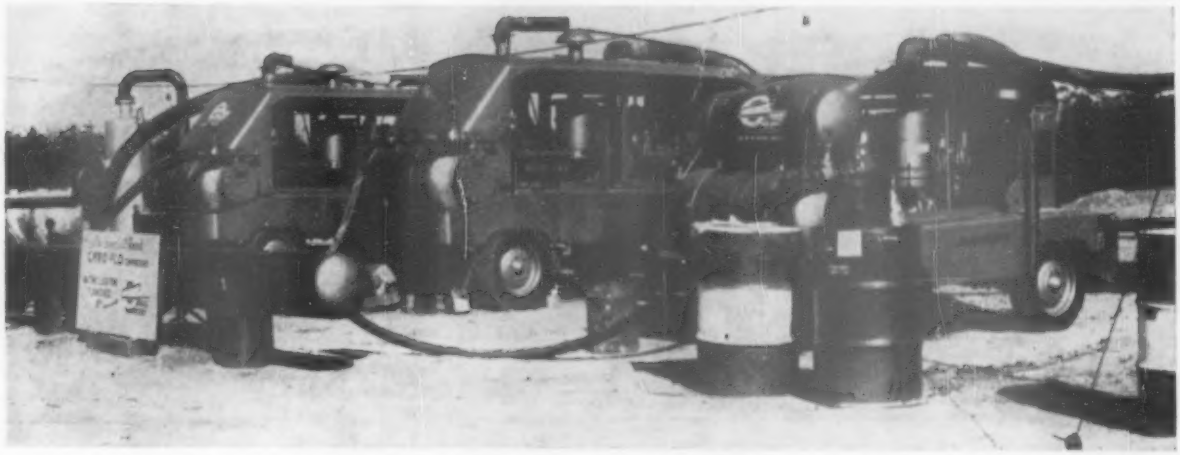
(b) Use E7016 low hydrogen-iron powder electrodes for all welds which are fused to the pipe wall, if the surface temperature of the pipe is below 50° F.

3. General

(a) Longitudinal seams of fittings designed to encircle the pipe shall be equipped with a steel backup strip to prevent the weld metal deposited in these seams from fusing to the wall of the carrier pipe.

(b) Carefully check all completed welds for underbead cracks with dye-penetrant material.

(c) The operating pressure in a pipeline at the location of welding shall be reduced to 200 psi. before any welding is started. This pressure shall not be increased until all welding on a line is completed. **End.**



FAST-MOVING ROTARY COMPRESSORS are paralleled for high volumes of air at low pressures of 100 to 110 psig.

Here's what one company discovered when it set out to survey what's available in

Equipment for Air Drilling

What kind of equipment should you have for air drilling? What types of compressors are available? Does present equipment meet the needs? This article sums up the experiences of El Paso Natural Gas Co. concerning these questions and gives the answers.

by V. A. LaFave

AIR drilling has reached a point where problems such as types and arrangements of equipment have at least partially been solved. The remaining problem is what capacity and pressure are to be expected of this equipment.

From El Paso Natural's experience in both air and gas drilling, an air-drilling unit has been found capable of delivering 3 M.M.c.f.d. of free air at 125 to 150 psig. and also has a capacity of approximately 2 M.M.c.f.d. of free air at 300 to 350 psig.—in most instances air drilling can be accomplished.

The equipment for air drilling, like all drilling equipment, is expensive. However it is only a matter of time until some of the problems such as weight and size limitations are solved and high-capacity and high-pressure machines are designed.

Types of compressors . . . Essentially there are only two types of compressors being used for air-drilling operations. These are the reciprocating and rotary types of compressors. With the reciprocating compressors, high pressures can be achieved by multistaging. The two-stage compressor has been the most popular and it is being offered complete with intake air filter, interstage and aftercooler, all mounted as a packaged unit.

Rotary compressors which can be mounted on skids or on wheels are being used in parallel operation where high volumes and low pressures are considered satisfactory for drilling (Fig. 1).

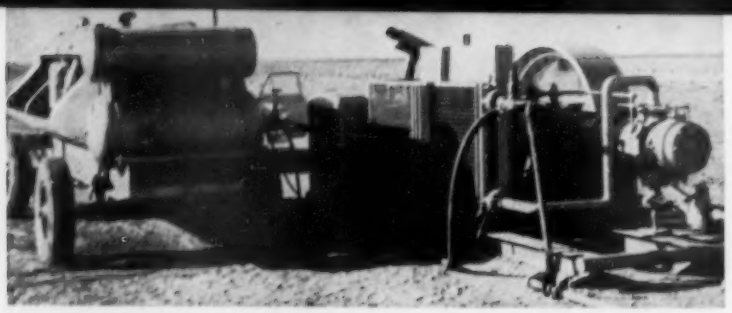
These compressors are capable of pressures of 100 and 110 psig. When higher pressures are required, a reciprocating booster may be connected on the discharge side (Fig. 2). Tests of a three-stage rotary, skid-mounted unit, complete with drives, intercooler and aftercooler, are being made now.

Arrangement of equipment . . . In the arrangement of air-drilling equipment, manufacturers have attempted to reduce as much as possible the weight and size of their units. This has been a very difficult task as the equipment they are using generally can be classified as heavy-duty machines. Generally speaking, the following four arrangements are the most feasible for air-drilling equipment:

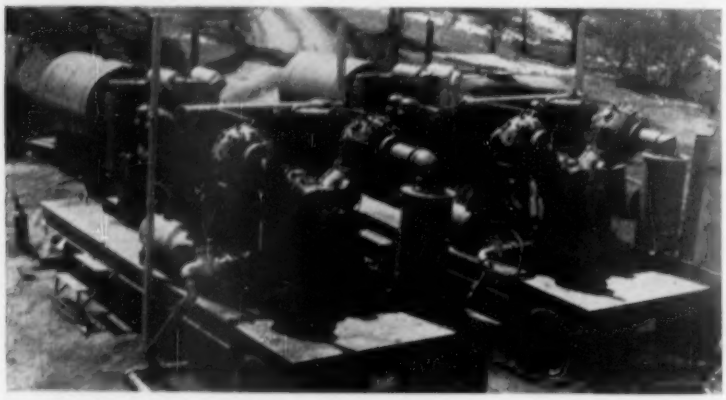
1. **Engine-driven compressor units mounted on trailer bed** (Fig. 3). This type of an arrangement is most satisfactory for use in a wildcat area where the required pressures and capacities for optimum drilling have not been determined. It consists of a two-stage air compressor with intake air filter, intercooler and aftercooler, driven by a standard industrial, high-speed type of engine.

All of this equipment is mounted on a heavy trailer type of skid, complete with its own fuel tank. It has high mobility as far as size and weight are concerned. With this type of arrangement, it could be decided whether air is feasible for drilling and, if so, the required amount could be determined.

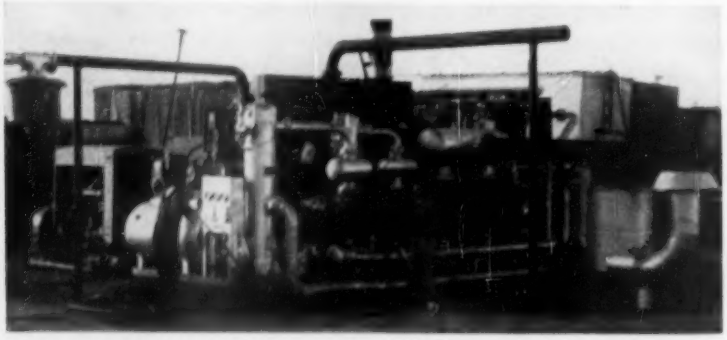
Author is with El Paso Natural Gas Co., El Paso, Tex. Paper presented at 1956 A.S.M.E. Petroleum Mechanical Engineering Conference, Dallas.



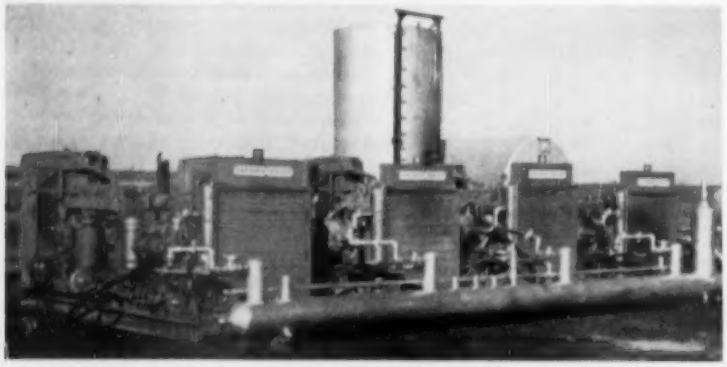
ROTARY AND RECIPROCATING compressors connected in series provide air at higher pressures than rotary type will produce. Booster may up pressure from rotary three or fourfold. Fig. 2.



TWO-STAGE RECIPROCATING compressors provide large volume of air and pressures up to 265 psig. These self-contained trailer-mounted units are good for exploratory air drilling. Fig. 3.



THREE-STAGE COMPRESSOR mounted on a skid will provide large volumes and high pressures. These large reciprocating units fit air-drilling requirements but are not as popular as smaller, more easily handled units. Fig. 4.



POPULAR SKID-MOUNTED UNITS are two-staged and can be compounded for high volumes. If any one unit breaks down sufficient air for drilling can still be produced. Fig. 5.

These units are designed for approximately 750 cu. ft. per minute and a discharge pressure of 265 psig. Experiments are being made with a booster on the inlet so as to raise the atmosphere pressure to approximately 10 psig. With this, the machine will be capable of delivering approximately 1,050 cu. ft. per minute at a discharge pressure of 125 psig.

2. **Skid-mounted engine-driven compressors.** Large-volume, high-pressure units can be skid-mounted (Fig. 4). But the smaller volume, high-pressure machines are becoming more popular in the drilling industry (Figs. 5 and 6). The equipment arrangement of these units is the same as the trailer-mounted units.

Any number of these units can be placed in parallel operation to satisfy the volume of air required. A decided advantage of these units is that if one is down for repairs, only a slight reduction in capacity will result. These are designed for 500 cu. ft. per minute each with pressure steps from 150 to 350 psig.

3. **Compound-driven compressors** (Figs. 7 and 8). This arrangement consists of a skid-mounted, belt-driven compound drive with two-stage oil-field type of compressor units. Each of these compressor units is mounted on an oil-field type of skid with combination jacket water cooler, intercooler and aftercooler. These compressors are driven by a heavy-duty chain drive mounted on an oil-field type of skid, with gear type of oil pumps for lubrication of chains and bearings.

Each compressor is bolted to the compound skid and doweled for field alignment. Each compressor unit is equipped with an air clutch and a hand-operating valve for the operation of the air clutch.

The entire compressor unit can be dropped out of operation by means of the clutch on the rig in the same manner that the mud pump is stopped. The air piping is permanently mounted along the compound floor. This type of an installation can take the place of one of the mud pumps.

If mud circulation is required, this compound could be clutched out and the mud pump put in operation. A decided advantage in this installation is that it can be broken down into several sections for ease of shipment. Also additional compressors can be added to the compound drive if more capacity is required.

Each of these two-stage compressors is designed for 500 cu. ft. per minute and a discharge pressure of 250 psig. At 250 psig. discharge, each unit would require approximately 200 hp.

4. **Compressors driven by V-belt**

from rig engine (Fig. 9). This type of arrangement is one where several compressors are connected to receive their power from a common shaft. Generally speaking, this type of arrangement is used for compressors of low discharge pressure. If higher pressures are desired, a small booster unit may be installed to satisfy the required pressure.

These units are designed for 600 cu. ft. per minute and a discharge pressure of 110 psig. It is possible for these units to go to a higher pressure, but the capacity output would be reduced. At 110 psig. discharge, each unit requires approximately 160 hp.

Equipment manufacturers have done a remarkable job in assembling units for air drilling from existing equipment. This is particularly true since much of the time they were working in a field of the industry where little or no data were available.

Capacity and pressure . . . In this regard, this one question is still being raised: What are the pressure and capacity requirements needed for compressor equipment for air drilling?

Obviously, before manufacturers can design new units, they must know more fully what is expected of the equipment.

However, that question is one of the most controversial subjects in air-drilling technique, and one which may be impossible to answer directly. It is difficult to predict what type of equipment is needed for any one drilling location or operation.

Curves have been calculated showing the required pressure and capacity for compressors for certain depths using a constant velocity. These curves are ideal in theory and may be correct; however, the variables that exist are too numerous.

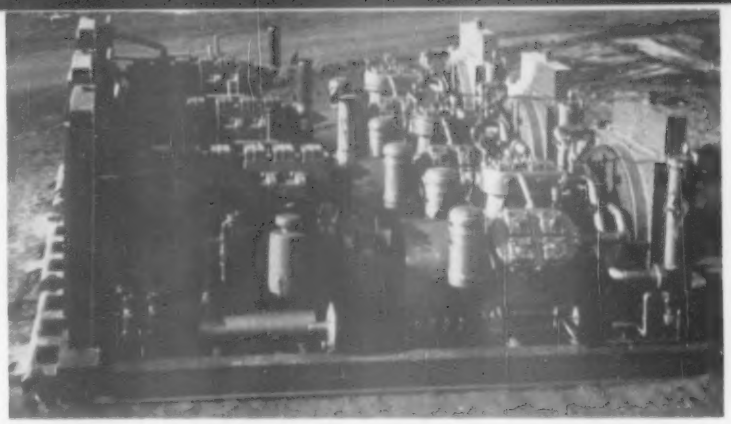
The industry is necessarily vague in what it expects of compressor equipment because of these variables:

1. Character of formation — from the hard, dry, consolidated types of formations which favor air drilling to those of a sloughing or caving type which become problems in air drilling.
2. The amount of fluid entering the hole.
3. Size and shape of drill cuttings.
4. Size of hole and drill-pipe size.
5. Pressure losses through air piping system.

Of these, character of formation and fluid entry have been the two most unpredictable variables that have affected compressor equipment.

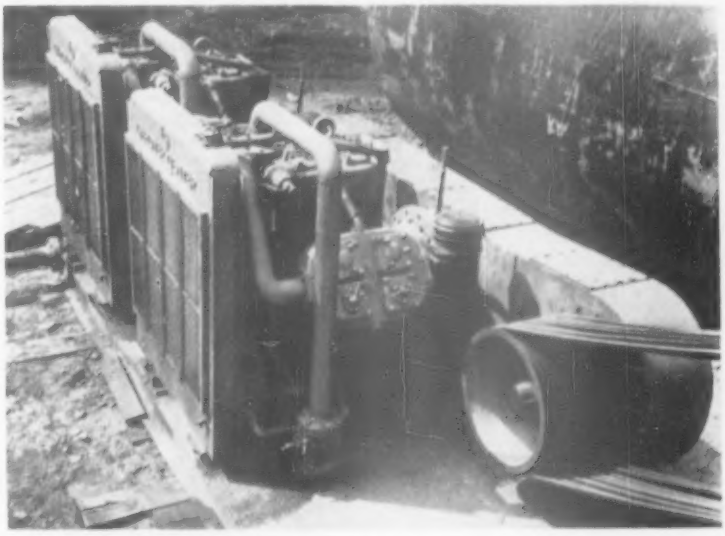
It appears that every area has its own air-drilling problems and in turn has its own capacity and pressure requirements for air drilling.

Rent or purchase? . . . It is obvious

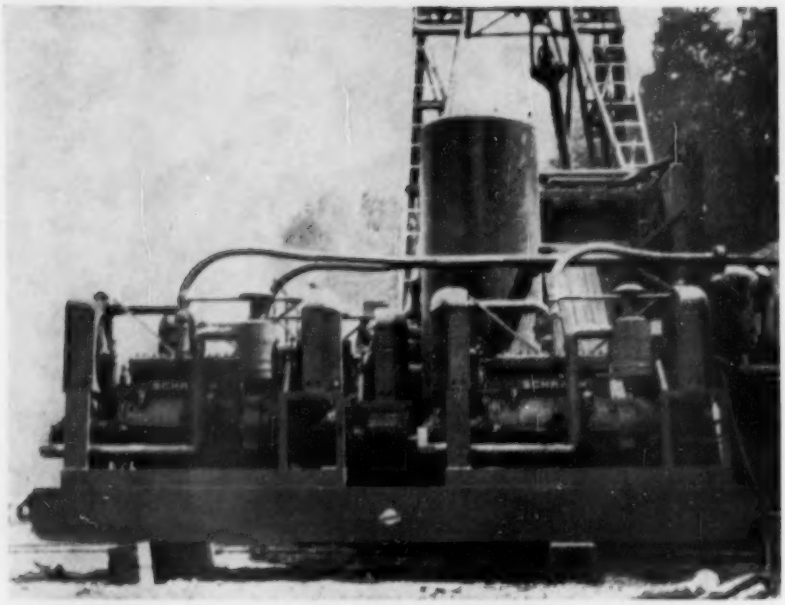


ENGINE AND COMPRESSOR of two-stage units form an easily handled skid package. Each compressor will discharge 500 cu. ft. per minute at 150 to 350 psig. Fig. 6.

RIG ENGINE POWER drives compounded two-stage compressors. Compressor unit can be dropped out of operation in the same manner as a mud pump connected to the main engines. Fig. 7.



COMPOUNDED COMPRESSORS belted to rig compound can easily be clutched out if mud pump is needed. These two-stage units produce 500 cu. ft. per minute at 250 psig. and require 200 hp. Fig. 8.



PACKAGED COMPRESSORS receive power from a common shaft driven by rig engine. This unit will discharge 600 cu. ft. of air per minute at 110 psig. At 110 psig. it uses 160 hp. Fig. 9.

that any type of equipment now available is expensive, and for that reason industry is confronted with the problem of whether it is better to buy or rent equipment.

A drilling company who plans to explore an unproved area and who intends to try air as a circulating medium in drilling may wish to look into the advantages of using a service unit before purchasing equipment.

Four important factors to consider are:

1. The frequency in which air drilling is to be used or number of wells to be drilled in the area.

2. The amount of volume and pressure that will be required.

3. The arrangement of equipment as to number of units and their method of drive.

4. The availability of personnel familiar with air drilling.

In those instances where El Paso Natural has used compressed air in drilling, equipment has been rented from one of the several service companies in business. Since 1951, El Paso Natural has drilled or partially drilled seven wells using compressed air, but has not conducted any experimental work in air drilling.

Service companies . . . There are service companies who offer trailer-mounted and skid-mounted compressors, complete with operator, on a rental basis. They offer a type of arrangement which can be connected up with the least amount of shutdown time. If necessary, two or more units can be hooked up for parallel operation.

If the formations drilled are not favorable for air drilling, these units can be disconnected and their service terminated at a minimum cost to the company. If the area is favorable for air drilling, the required pressure and capacity can be determined from a pressure and flow recorder installed to operate on a flow line from these units.

Once the maximum requirements have been determined, the drilling company can then either rent or purchase equipment necessary to fulfill its needs. The primary reason for using these trailer or skid-mounted units is to find out if air is feasible and then determine the maximum volume and pressure that will be needed for the area which is to be drilled. These units offer extreme flexibility to the drilling company.

Several of the advantages they offer are:

1. A two-stage compressor capable of delivering high pressures. Additional units can be connected for parallel operation as extra volume is required.

2. A compressor unit mounted on a trailer for fast transportation, and completely unitized with fuel tank, cooling system, and engine.

3. The compressor remains on trailer and can be quickly manifolded into the rig circulating system.

4. Each unit can have its own experienced operator, if desired.

BOOKS

ELECTRIC POWER DISTRIBUTION FOR INDUSTRIAL PLANTS, Second Edition. Published by the American Institute of Electrical Engineers, 33 West Thirty-ninth Street, New York 18. 172 pp. $3.50. Discount of 50 per cent to members.

This book consists of 10 chapters on system planning, voltage considerations, system protection, fault calculations, grounding power factor, power equipment, instruments, conductors and terminators, and relative cost of industrial distribution systems.

Prepared by the Subcommittee on Electric Power Distribution for Industrial Plants of the Industrial Power Systems Committee, this book represents 3 years of work by 86 leaders in the field of electric-power distribution. H. B. Thacker, Westinghouse Electric Corp., Pittsburgh, was chairman of the committee directing and coordinating the revision.

THE CHEMISTRY OF PETROCHEMICALS by M. J. Astle. Published by Reinhold Publishing Corp., 430 Park Avenue, New York 22. 267 pages. $6.50.

The author of this book is professor of organic chemistry at Case Institute of Technology. The book is a rather broad survey covering the preparation and important chemical reactions of industrial chemicals made directly or indirectly from petroleum hydrocarbons. Subjects include syntheses and reactions of paraffin hydrocarbons; preparation and reactions of olefins; diolefins; acetylene; naphthenes; aromatic hydrocarbons; olefin oxides; alcohols and ethers; aldehydes and ketones; acids, acid anhydrides and esters; amines and nitriles. The book serves as a good introduction and survey of the chemistry of petrochemicals.

OIL AND PETROLEUM YEAR BOOK, 1956 edition. Published by Walter E. Skinner, 20 Copthall Avenue, London, E.C.2. 700 pp. $6, postage free.

This is the forty-seventh year of publication for this standard reference which gives complete particulars of organization for 950 oil companies. This includes: names of directors and officials, description of business, where operating, crude-oil production, refinery runs, details of capital, dividends, and financial results.

The book also contains: buyers' guide section, managers, engineers, and agents section, world crude-oil and natural-gasoline tables, and other valuable information.

BIOLOGICAL TREATMENT OF SEWAGE AND INDUSTRIAL WASTES by Brother Joseph McCabe and W. W. Eckenfelder, Jr. Published by Reinhold Publishing Corp., 430 Park Avenue, New York 22. 393 pages. $10.

This is Vol. 1: Aerobic Oxidation of a series bearing the title given above. Vol. 1 records the proceedings of the First Conference on Biological Waste Treatment held at Manhattan College. The book includes 33 papers contributed by authorities and covering latest trends in research, development, and plant design of bioxidation processes. Four sections cover: basic biochemical principles and their applications in activated sludge and trickling filter processes; basic theory of oxygen transfer and its application to design of aeration equipment; design and operation of typical sewage and industrial waste-treatment processes.

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In Oil-Well Pumping, Fit the Motor to the Job

Unless field engineers and foremen understand characteristics of electric motors, they may unknowingly install as much as twice the horsepower needed for pumping oil wells. This article presents the formulas and lists the instruments needed to make realistic selection of electric-motor sizes.

by F. W. Beach

THERE are many reasons why oversize electric motors might be found on electric-powered pumping units. Some of these are:

1. Selection of motor based on other wells in area.
2. Selection of motor based on gas-engine size.
3. Selection of motor based on pumping-unit size.
4. Optimistic estimation of well productivity.
5. Heavy production of water did not materialize.
6. Well declined in production after motor was installed.
7. Lack of understanding of electric-motor characteristics in pumping-unit service.

Effect of Using Oversize Motors

The effect of using oversize electric motors for pumping-unit installations is far reaching. Increased cost of motor and starter boxes is of considerable magnitude on a companywide basis. Many field electric systems are designed according to the anticipated horsepower load. This means that if the motor-size needs are not realistically evaluated, the transmission system and transformers will be much larger than necessary. This results in greater investment.

It might be well to err on the high side insofar as wire is concerned, but motors, starters, and transformers can be changed if they are too small.

The electric induction motor when applied to oil-well pumping is near its highest efficiency and power factor when fully loaded. Therefore, when an oversize motor is used, a penalty is paid for decreased electrical efficiency and a decrease in power factor. The result is a greater electric energy cost per barrel of fluid pumped.

TABLE 2—NUMBER AND SIZES OF MOTORS INSTALLED TO SIZES NEEDED

Motor size	Number installed	Number needed	difference
10	421	128	—293
20	121	47	— 74
7½	109	106	— 3
25	34	6	— 28
15	63	40	— 23
40	3	2	— 1
30	3	3	0
5	89	257	168
3	79	203	124
1½	0	130	130
Total	922	92	

TABLE 1—SUMMARY OF ELECTRIC-MOTOR-POWERED PUMPING UNITS

Dist.	No. Wells	Hp. Installed	Hp. necessary to pump present Production	Excess Hp.	Hp. necessary to pump ultimate Production	Excess Hp.
1	343	4,107	1,837	2,270	2,170	1,937
2	156	1,785	838	947	1,016	769
3	61	640	480	160	490	150
4	14	220	135	85	135	85
5	33	99	51	48	51	48
6	5	25	19	6	19	6
7	12	160	73	87	100	60
8	28	177	100	77	113	65
9	12	77	61	16	61	16
10	121	1,517	718	799	784	733
11	64	485	239	246	239	246
12	3	75	9	66	30	45
13	65	765	444	321	445	320
14	4	14	7	7	7	7
15	1	15	5	10	5	10
Total	922	10,162	5,018	5,144	5,665	4,496

Cities Service Experience

During the early part of 1955, a survey was made of all Cities Service Oil Co. wells pumped by electric power. The object of the survey was to tabulate the number of wells pumped by electricity, the horsepower installed and the fluid pumped by the installed horsepower. A summary of this tabulation is in Table 1.

This tabulation indicated that we had twice as much horsepower installed as was necessary to pump the actual production from the wells.

A study was then made to determine number and sizes of motors installed as compared to the number and sizes of motors actually needed. This is shown in Table 2.

What could be saved . . . As a matter of interest another study was made to determine the savings that could have been made on electric-motor cost alone if the correct size of motor had been installed. The result was that on 922 wells a total savings of $73,200 could have been made not counting starter boxes and transformer capacity.

These studies indicated that we had far too many oversize motors installed on our pumping wells.

Since our electrification program is

Author is with Cities Service Oil Co., Bartlesville, Okla. Paper presented at the 1956 A.I.E.E. electric conference of the petroleum industry, Kansas City.

PRODUCING

constantly growing, we were faced with the problem of providing our field men with sufficient tools and information on electric pumping motors so that future installation could be sized more in line with actual needs.

Sponsored education . . . With the help and advice of Phillips Petroleum Co. engineers, our own electrical engineers, and the engineers of several power companies, a handbook of electric-motor information was prepared for our field men. Each district was provided with a group of electric instruments for testing the performance of electric motors on pumping wells.

The results of this program to improve our electric-motor use has been very gratifying. The men in the field, generally not experts in electricity, have for the first time a way of analyzing electric-motor performance that can be directly employed to size pumping-unit installations correctly. The results have been that we are now buying smaller motors for new installations and replacing large motors with smaller motors where larger motors can be used elsewhere.

Since we have had such good results with this approach of providing the instruments and a method of determining required motor size, others might benefit from our experience.

The remainder of this article will present electric-pumping-motor characteristics and a method for determining electric-motor sizes for oil-well pumping service.

Electric Motors for Oil-Well Pumping

Electric motors for oil-well pumping must have the following qualifications:

1. High starting torque.
2. Sufficient horsepower capacity to pump the well under fluctuating load conditions without overheating.

The electric motor applied to pumping-unit service is subjected to more severe service than a similar motor on a steady load application.

The ordinary pumping unit is a heavy piece of equipment which has a certain amount of frictional resistance to movement. In addition, the motor must start from rest a long string of rods and tubing full of fluid. The friction and inertia resistance of these components require the pumping-unit motor be able to develop a high starting torque about 200 to 350 per cent of full running torque. Once the load is started the electric motor must have sufficient capacity to keep the equipment in motion without overheating.

The reciprocating action of the pumping action causes the power output of the motor to vary from less than zero to 2 to 3 times its normal rated capacity. Each stroke of the unit causes four power reversals which in turn cause more heat to be generated within the motor windings than would be the case under steady load application for a given average power output.

The size of a motor required to pump a well is not only dependent upon the horsepower but also upon how much heat the motor will generate and stand for the load in question.

Determination of Motor Performance

The performance of an electric motor on a pumping well can be evaluated if certain electric factors can be determined. The electric measurements which must be determined are: (1) Voltage, (2) instantaneous amperes, (3) kilowatts, and (4) thermal amperes.

The motor factors which can be evaluated are:

1. Line voltage to motor:

(a) Low voltage; (1) maxmium torque reduced—stall on small overloads, (2) increase amperes which causes increased heating of motor.

(b) Unbalanced voltage between phases; (1) cause excessive heating. Reduces hp.-output capacity of motor.

(c) High voltage—if not excessive will not cause trouble.

2. Instantaneous amperes:

(a) The instantaneous ampere determination is useful only for adjustment of the pumping-unit counterbalance for proper balance. A well should be fairly well balanced before motor-size determination is made.

3. Kilowatts:

(a) The average kilowatt input to a motor can be directly determined. From the kilowatt input the average horsepower input can be determined by:

$$\text{Hp.} = \frac{\text{kw. input}}{0.746}$$

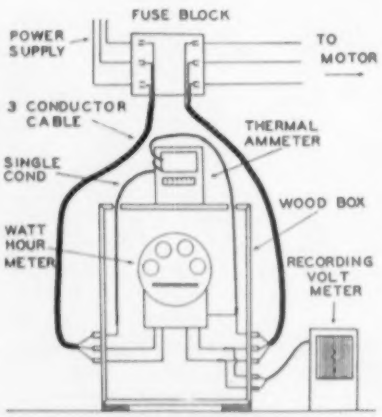


Fig. 1—Test box.

(b) The average kw. input is also used to determine the power factor for three-phase motors as follows:

$$\text{P.f.} = \frac{\text{kw.}}{1.73 \times \text{amp.} \times \text{volts}}$$

4. Thermal amperes:

Thermal amperes is the actual heating value of the current. The thermal ampere reading will indicate:

(a) Whether the electric motor under test is overloaded. If the thermal ampere reading is greater than the ampere rating shown on the motor name plate, the motor is overloaded.

(b) The thermal ampere reading is used in power-factor calculations.

Instruments for Motor Testing

Instruments required:

1. Snapon ammeter and voltmeter.
2. Watt-hour meter.
3. Thermal ammeter.
4. Tachometer.

The above instruments for convenience are combined in a testing kit. The watt-hour meter is installed in a box with 6 to 10-ft. No. 10 rubber-covered wire leads. The cost of a well-testing kit is as follows:

WELL-TESTING KIT COST

Snapon voltmeter and ammeter	$64
Watt-hour meter (15 amp.)	50
Heavy-duty max.—I-meter thermal ammeter	95
Tachometer	*25
Stopwatch—graduated in 1/100 minutes	25
Recording voltmeter	*100
Miscellaneous wire and connections	10
Meter box	15
Electrician's gloves	5
Total	$389

*Desirable but not necessary.

Use of test instruments . . . The electric-motor test kit is put into service by connecting the test kit into the line between the motor and switch box. All of the electric energy then flows through the test box. See Fig. 1.

Instrument Uses

. . . Snapon ammeter and voltmeter. The ammeter is used for counterbalancing the pumping unit and is used by snapping around a single wire. The ammeter indicates the cyclic ampere load on the motor. Counterbalance is adjusted until the peak ampere reading on the upstroke and downstroke are approximately equal.

The voltage can be determined from the same instrument. The two leads are connected to two phases of the circuit. Voltage should be checked between legs 1-2, 2-3, and 1-3.

. . . Watt-hour meter. A two-element

220/440-volt three-phase watt-hour meter is connected so that two phases pass through the meter. The third phase is used only for voltage supply to the meter. A 15-amp. meter is used for motors up to 15 hp. However, these meters can stand a 300 per cent overload and larger motors can be tested without harm to the instrument.

The kilowatt-hours are indicated by a register. However, since it is usually the practice to obtain the tests in as short a time as possible, the rotating disk is used to determine kilowatt input and horsepower.

The rotating disk revolves at a speed proportional to the electric energy being used. The dial has a constant K marked on the face of the meter.

To determine the average kilowatt input, use a stop watch to obtain disk revolutions per minute. Then:

$$\text{Kw. input} = \frac{K \times \text{r.p.m.} \times 60 \text{ minutes}}{1{,}000}$$

To obtain the average horsepower input, divide the kilowatt input by 0.746.

...Thermal ammeter. The thermal ammeter measures the effective thermal ampere load on a motor. Since this is a thermal unit, it requires 45 minutes to obtain a reading.

The thermal ammeter is used to determine two things:

1. If the maximum ampere indicated by the thermal ammeter is greater than the ampere rating indicated on the motor name plate, the motor is overloaded no matter what the horsepower input may indicate.

2. The second function is for power-factor determination:

$$\text{Power factor} = \frac{\text{kw.}}{1.73 \times \text{amp.} \times \text{volts}}$$

...Tachometer. A tachometer is useful in determining if a motor is running at its full-load rated speed. A subnormal full-load speed could be caused by a low voltage, overload, or a faulty motor.

The above instruments are useful in determining the conditions existing on electric-powered pumping units already in service. It will indicate when smaller motors may be substituted for larger motors. The tests will also indicate when low voltage is prevalent, which might cause motor failures.

Motor Size on New Installations

The size of motor needed for a new pumping-unit installation can be determined in two ways.

1. By installing a test motor and using test instruments to determine exact size of motor needed.

2. By dynamometer tests which give an accurate value of average horsepower at the polished rod. Required motor rating is:

$$\text{Name-plate horsepower} = \frac{\text{Polished-rod horsepower}}{\text{Surface efficiency}} \times \text{C.L.F.}$$

The surface efficiency of a pumping unit may vary from 40 to 80 per cent. The cyclic load factor varies according to the average polished-rod

Electric-Motor Test Sheet

Date
Sheet No.
Engineer
Lease ..... Well
State ..... County
Field ..... Depth
Formation
Electric-motor name
Rated horsepower
Voltage
Ampere rating
Rated r.p.m.

Test Data

Load, r.p.m.
Voltage loaded 1-2 , 2-3 , 1-3
Amp. upstroke ..... Down
Wattmeter constant K =
No. revolutions =
Time—minutes =
R.p.m. =
Kw. = K × r.p.m. × 0.06 =
Hp. = kw./0.746 =
or

$$\text{Hp.} = \frac{347 \text{ (15-amp. metter rdg.)}}{\text{No. sec. for 5 rev.}} =$$

(Thermal ammeter time 50 minutes)

Production Data
(Theoretical production)

$$\text{Bbl. per day} = \frac{d^2 \times S \times \text{s.p.m.} \times \text{pump eff.}}{8.583}$$

Bbl. per day =
8.583
Bbl. per day =
Actual pumping test =
Bbl. per kw. =

Thermal Ammeter

Ratio used ..... No. wraps
Resulting ratio
Dial reading
Corrected reading
Correct reading × resulting ratio
Ratio r.m.s./rated

$$\text{Kva.} = \frac{1.73 \times \text{volts} \times \text{amp.}}{1{,}000}$$

Kva. = 1.73 × × =
1,000
Kw. = ; Kva. =
P.f. = kw./kva. =

Outside temperature
Motor temperature
Motor noise

Well Data

Size casing ..... Set
Tubing size ..... Set
Rod size
Pump size
Pumping unit name
Rated horsepower
Gear box
Stroke lengths
Counterbalance
No. weights
Gear-box ratio
Sheave-size motor
Sheave-size unit
Stroke used
S.p.m.

TABLE 3—INSTRUMENT TESTS ON PUMPING WELLS

Well No.	1	2	3	4	*4	5	6	7	8	9	10	11	12
Depth, ft.	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	3,000	4,950	2,300	2,300	2,300
Motor, horsepower	20	20	20	20	15	20	20	20	7½	7½	15	15	15
Volts—rated	440	440	440	440	440	440	440	440	440	440	440	440	440
Amperes—rated	25.5	25.5	25.5	25.5	20	26	25.5	28	11½	11½	20	19	19
R.p.m.	1,140	1,140	1,140	1,140	1,110	1,110	1,140	1,175	1,175	1,140	1,170	1,175	1,175
Operating voltage	454	484	484	384	390	425	430	435	452	468	468	467	468
Ampere fluctuation	12-13	20-20	17-16	48-43		30-32	45-38	16-14	8-9	14-16	5-10	20-21	6-6
Thermal ammeter	10.1	12.1	11.9	28.4	18.4	16.4	29.6	11.8	6.9	8.9	4.7	8.0	6.7
Ratio r.m.s./rated, per cent	39½	47	46	101	92	63	116	42	60	78	24	42	35
Kva.	7.9	10.1	10.0	18.8	12.4	12.1	22.1	8.9	5.4	7.2	3.7	6.5	5.4
Kw. (watt-hour meter)	3.25	6.02	4.39	9.6	9.3	9.0	15	4.5	2.2	3.4	1.9	3.8	2.4
Power factor, per cent	41	59.5	44	51	75	75	68	50	40	47	53	59	43
Input horsepower	4.4	8.0	5.9	12.9	12.4	12.1	20.1	4.5	2.9	4.5	2.8	5.1	3.1
Production total fluid, bbl.	111	189	181	280	280	372	553	96	50	80	82	97	38
Motor-size installed	20	20	20	20	15	20	20	20	7½	7½	15	15	15
Motor-size needed	5	10	7½	15	15	15	20	5	3	5	3	5	5

*High-slip motor installed.

speed, the kind of counterweight and whether a normal or medium-slip motor is used.

Neglecting the effect of counterweight, which is rather small, the cyclic load factor which we use is as follows:

CYCLIC LOAD FACTORS

Polished-rod speed (S × s.p.m. × 2)	Normal slip, 3-5 per cent	High slip, 5-8 per cent
0-1,500	1.62	1.15
1,500-2,000	1.77	1.28
2,000-2,500	1.91	1.42
2,500-3,000	2.03	1.54

Westinghouse has published a set of cyclic load factors and Phillips Petroleum Co. has also established a set of cyclic load factors. The above factors are what we believe best fit our needs.

3. Motor size may be calculated by the following formula:

$$\text{Name-plate motor Hp.} = \frac{\text{Hydraulic Hp.} + \text{Friction Hp. (Subsurface)}}{\text{Unit efficiency}} \times \text{C.L.F.}$$

$$\text{Hydraulic Hp.} = \frac{Q \times H \times \text{S.G.}}{135{,}600}$$

Where:

Q = volume of fluid in bbl. per day

H = hydraulic lift, ft.

S.G. = specific gravity of fluid

$$\text{Friction Hp.} = \frac{\text{S.p.m.} \times \text{stroke} \times \text{weight rods}}{1{,}600{,}000}$$

The above formula will give a close approximation on motor size for a normal well. Crooked-hole condition, paraffin, and other unforeseen complications could throw off the calculation. Therefore, it is advisable to check the installation with instruments after it is in operation.

Nema motor designations . . . Induction motors commonly used for oil-well pumping service are available in three standard classifications. These are designated as follows:

1. Nema design B—normal current inrush, normal starting torque, normal slip 3 to 5 per cent.

2. Nema design C—normal current inrush, high starting torque, normal slip 3 to 5 per cent.

3. Nema design D—normal current inrush, high starting torque, high slip 5 to 8 per cent.

Nema design B can sometimes be used for light pumping loads. It may be necessary to rock the well due to limited starting torque.

Nema design C is the most commonly used oil-well pumping motor. Oversize motors may be necessary for hard-starting applications.

Nema design D has high-starting and accelerating torques. The increased slip also reduces current peaks and reduces the thermal amperes for a given average horsepower output.

. . . Starting torque values expressed as a percentage of full-load torque are as follows for a 10-hp., 1,200-r.p.m. motor:

Nema B—150 per cent.

Nema C—225 per cent.

Nema D—275 per cent.

Cities Service up until 1955 used no Nema design D motors. At the present time, we are specifying design D motors for almost all pumping-unit installations except in the 3 to 5-hp. class.

Following are what we believe to be the advantages of design D motors:

1. Availability—same as other motors.

2. Cost—same or up to 3 per cent greater.

3. Size—standard Nema frame.

4. Starting torque—up to 100 per cent greater depending upon horsepower.

5. Accelerating torque—greater than design C motors.

6. Cyclic current peaks—reduced more than half.

7. Temperature characteristic—carry more horsepower with much less heat development.

8. Power factor—may be up to 20 points higher.

9. Power consumption — very little difference.

10. Cyclic load factor—normal-slip motors can carry up to 62 per cent of name-plate current rating without overheating. Design D motors can carry up to 87 per cent without overheating. **End.**

It's New . . .

Gas Chromatography

. . . and we have a special report on it in this issue, starting on page 126. This 10-page section consists of seven different articles, each dealing with a different phase of analysis by chromatography. Read it for ways to cut down on your analytical load.

CONTINENTAL OIL CO. has designed a unique well-testing device to gage oil and water production from individual wells. First installation has been on Continental's Settles waterflood project.

Continental did not wish to tie up a stock tank for individual well testing. A small well-testing device, separate and distinct, was desired which would also require less time to operate than that required to bleed off water and gage tanks in the conventional manner. Since these wells make very little gas, a tester which makes use of gas pressure for dumping a measured volume of oil could not be used.

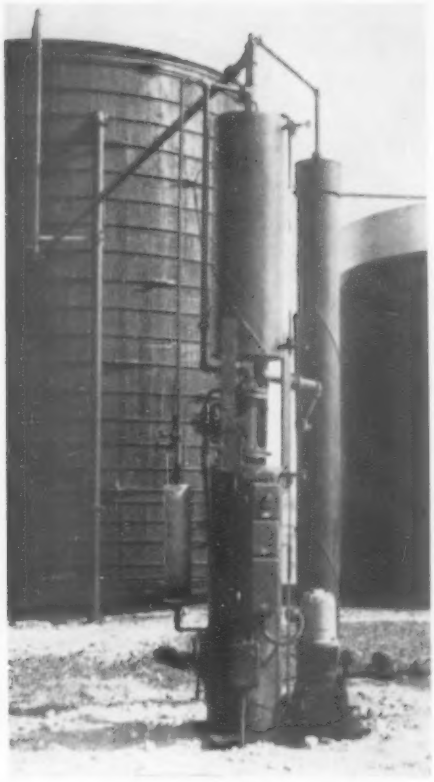
No commercial tester suitable for this application was available, so Conoco's division electrician designed the new gaging unit (Fig. 1). It makes use of an electric-motor-driven centrifugal pump to automatically empty a calibrated enclosed 1-bbl. tank each time it is filled.

How it works . . . Fig. 2 shows the oil and water production coming from a well and passing into separator or surge tank "A." This has a higher elevation than measuring tank "B." The fluid then drains by gravity through gas trap "C," where any remaining gas is removed, then through check valve and through the centrifugal pump — the pump being shut down—into tank "B." (This flow is in reverse direction from that when tank "B" is being emptied by running the pump.)

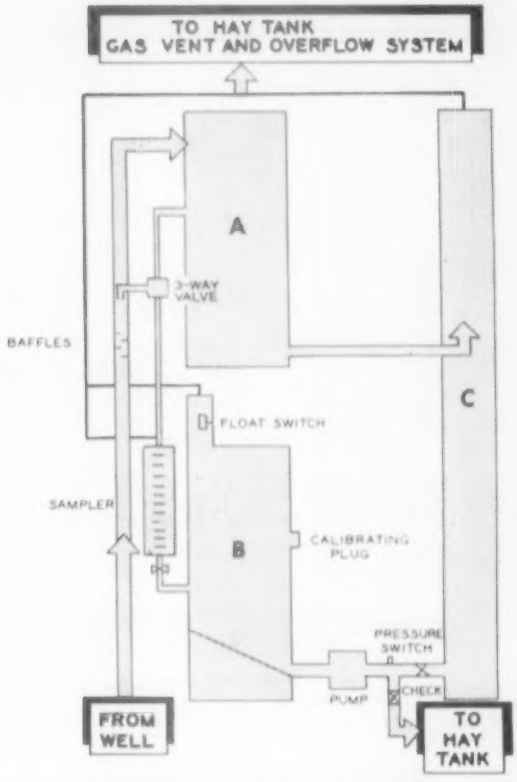
When tank "B" is filled, a float switch starts the pump. This pumps all the fluid from the 1-bbl. measuring tank into the manifold where it mixes with production from other wells. A pressure switch stops the pump when it loses pressure from lack of fluid. The other check valve prevents back flow of fluid when pump stops. The cycle is then repeated.

Record . . . Each starting of the pump is recorded automatically on a chart and a counter, so the total production at any time is readily available (Fig. 3). The counter shows the total production during a test while the chart shows the time when each barrel is produced, so the time of any decline or pumping off of a well can be noted.

Initially, only two vessels ("A and "B") were incorporated in the tester. However, several of the wells on the lease contained sufficient solution gas to cause the pump to gas-lock. Rather than reopen the upper vessel "A" and include some other gas-separation device, it was thought easier to install the third vessel "C." Since that time, there has been no trouble with gas lock. When the next tester is built, gas-separation devices will be installed



NO GAS PRESSURE is required with this dumpmeter apparatus. Accuracy of volume measured is within 0.5 per cent. Samples taken automatically with each dump give water content with an accuracy within 5 per cent of total water. Fig. 1.



PARTS OF TESTER are separating surge tank A, measuring tank B, and gas trap C. The sampler receives flow for 10 seconds for each dump. When the water-oil ratio is determined for each test, it can be dumped into tank B. Fig. 2.

Well Tester Scores High in Accuracy

Continental-designed device will handle wells to 275 bbl. per 24 hours.

by G. F. Duncan and J. D. Leonard
Continental Oil Co.

RECORDERS of test production are dump counters, top, and dump timer, bottom. Fig. 3.

in the upper vessel to eliminate this trouble. The upper vessel "A" can be set on the ground if desired, but must have sufficient volume above top of tank "B" to hold oil being produced while pump is emptying tank "B."

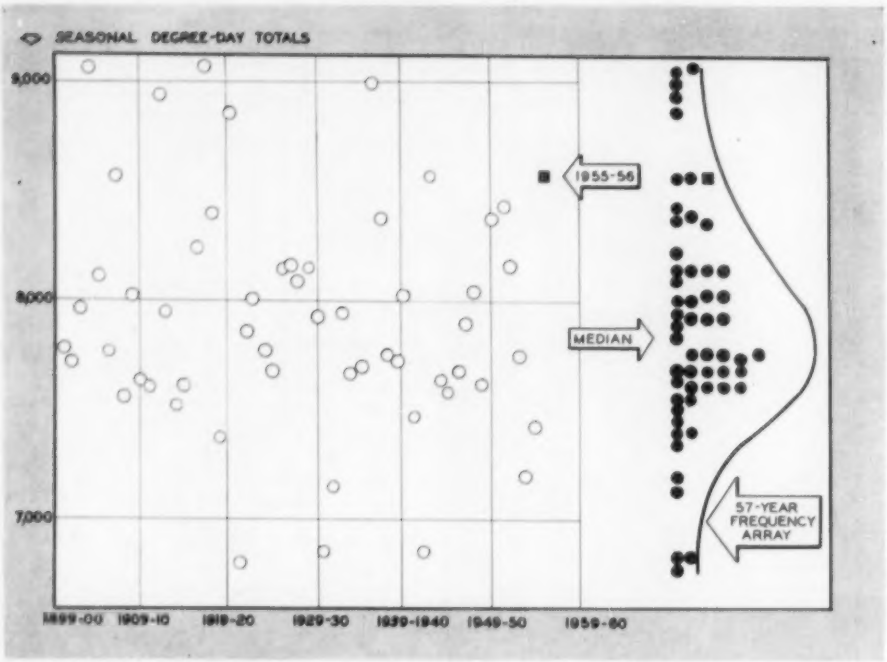
Water gage . . . To obtain the water-oil ratio, well fluid from the center of a vertical line is bypassed through a three-way ¼-in. magnetic valve for about 10 seconds. The valve then changes and allows the fluid which is in the top part of the bypass line to drain into the sample container. This occurs each time the motor operates. It could be arranged to collect a sample at regular time intervals instead of one sample per barrel.

Accuracy is good . . . A number of tests were made to determine the accuracy of this tester. After several changes in the size of the calibrating plug, the error was less than 0.5 per cent as compared to tank gaging. The water-oil ratio accuracy is not quite so good, but averages within 5 per cent as compared to bleedoff and gaging tanks.

The test unit will handle wells up to about 275 bbl. per 24 hours. It is connected through a manifold so that any one of the 15 wells pumping into this tank battery can be manually switched through it.

This tester operates on the same principle, but is a slightly modified version of a smaller and portable model for which a patent has been applied. The portable model was primarily intended to be used on stripper wells to determine when they started to decline in production or begin to pump off, so they could be pumped more efficiently. **End.**

PRODUCING



HISTORICAL RECORD of 9-month seasonal degree-day totals at Minneapolis, and 57-year frequency array. Fig. 1.

Let "climatic odds" guide you in

ESTIMATING YOUR FUEL-OIL MARKET

It's impossible to determine a growth pattern and to estimate how much fuel oil your customers will demand in a certain area of the country unless you have made a long-term study of the weather in that locality. You need to know what the "climatic odds" are that the weather will be colder, hotter, or about the same as last year.

by Loren W. Crow
Consulting Meteorologist

WHAT are the "climatic odds" that your company's fuel-oil requirements will be lower this winter than they were last winter?

The answer to that question can be determined by a careful examination of past weather data in your particular area.

For Minneapolis, the climatic odds are 10 to 1 that the heating season from September 1956 through May 1957 will have fewer degree-days (be warmer) than the same period last year. It isn't often that planning decisions can be based on odds that are that high.

This warmer weather will mean a correspondingly lower consumption of fuel oil. It will be reflected in a lower quantity of fuel oil required from the refineries which serve that marketing area. The pipelines, motor transports, etc., will move fewer barrels.

Although the oil industry is experiencing a continuing growth in the overall market for petroleum products throughout the United States, there is one large segment that remains and will remain highly variable due to fluctuations in the weather. The quantity of distillate used for fuel in space heating is directly influenced by the variations in temperature in each marketing area.

Weather forecasts vs. climatic odds . . . Because this variability can and does affect so many departments of each integrated oil company and the pipelines that help in the delivery of their products, there is a vast potential use of **highly accurate** long-range temperature forecasts. Such forecasts are **not** currently available. Research and progress in this field are very slow. The time required to properly test any new developed technique is such that improved differences can only be proved in intervals of 10 or more years. Fifty and one hundred years hence there will still be a need for more accurate long-range temperature forecasts.

Having accepted the above facts, we must then use the best information that is **currently** available. It is the intent here to emphasize the uses which can be made of material obtained from detailed examination of past climatic data. By using such data the **climatic odds** can be given for what to expect in the

REFINING

way of temperatures or degree-days for any period in the future. A distinct advantage in using climatic odds is that they can be easily expressed in numerical probabilities.

Climatic range remains unchanged . . . It is important to understand the **climatic range** continues to be satisfied at any one location over long periods of time. The variation in coolness in two succeeding seasons may differ by 1,000 degree-days or more, but both of the seasonal totals will remain **within** the climatic range for that location. When a description is given of the winter-time climate at a specific location, the most complete picture of the climatic range is shown by presenting the entire array of past data both on a time scale and a frequency scale. If the period covered extends over 40 or 50 years, this gives a very good definition of the climatic range for that particular station. Most of the values will fall somewhere near the median value, and there will be infrequent occurrences of values near the extremes. The longer the period covered, the less chance there is that any future value will be an extreme which is either colder or warmer than the extremes already established.

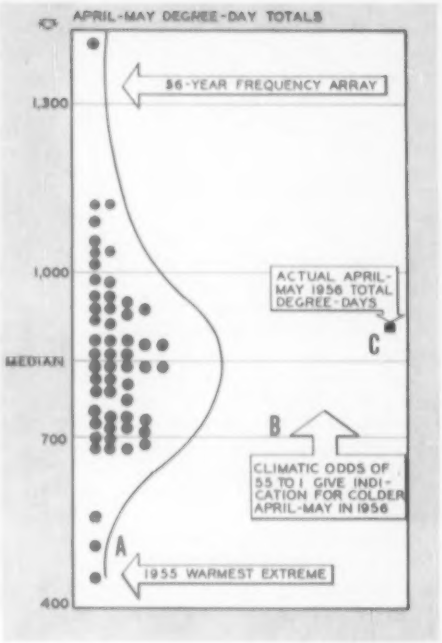
For planning fuel-oil requirements several years in advance, one can use the median value of degree-days for a particular station as the best single value. However, it should also be considered that either one of the two extremes could occur and the supply and storage facilities should be designed so that either extreme could be met.

Climatic change extremely small . . . Although we have overwhelming evidence that there is a constant gradual change of the climate in every area of the globe, we can also be sure that these changes are very, very slow in their occurrence.

A recent research report dealing with temperature at St. Louis showed that climatic change can and does take place at a rate of approximately 1° in 50 years. This would mean a change of only one-fiftieth of one degree each year. In terms of degree-days, this would only account for a change of about 5 degree-days per season. That amount of change would be insignificant for a location which experienced from 7,000 to 9,000 degree-days per season.

Outlook for 1956-57 season . . . Although the use of climatic odds will not deliver a specific detailed forecast of a given quantity of expected degree-days, it can yield useful information regarding the changes to expect from one season to the next. For the 9-month period, September 1956, through May 1957, the climatic odds are 10 to 1 that the degree-days at Minneapolis will be fewer than they were in the same period last year.

USE OF climatic odds is shown in this example. A—Position of 1955 April-May degree-day total, in relation to 56-year array of data for same period at Minneapolis. B—Indicated change for same period in 1956. C—Actual degree-days in April-May period, 1956. Fig. 2.



An examination of Fig. 1 will show the background for the development of the above statement. After careful adjustment was made for all of the temperature observations made at other earlier locations, (temperatures are now recorded at the Airport Weather Station) comparable values are presented for fifty-seven 9-month winter seasons at Minneapolis. All of the values shown are directly comparable to the degree-days which would be recorded by the present location of the thermometers at the airport. At the right-hand side of Fig. 1 is shown the frequency array of the various values which were recorded during the 57 seasons.

The 1955-56 seasonal total is shown by a small square in both the time series and the frequency array. The total for the 1955-56 season was among the coldest which have been recorded at Minneapolis. In fact, there was 1 season which was almost exactly the same, 5 that were colder, and 50 that were warmer. It has already been mentioned that the climatic range for any particular station will continue to prevail over long periods of time. Thus the climatic odds are 50 to 5 (10 to 1) that the 1956-57 season will be warmer than the 1955-56 season in Minneapolis.

The next question to be asked would be "How much warmer?" While a single specific forecast is not possible by the use of climatic odds, the frequency array shows the highest probability for some value between 7,600 and 8,000. This could mean a reduction of some 800 degree-days from the total that occurred in 1955-56. It should be emphasized here that the greatest use of climatic odds is for giving an indication of the **direction of change** to be expected.

Estimating market growth . . . In addition to the changes in weather from one season to the next, there are also other factors contributing an influence on the total fuel-oil sales figure. One of these would be the growth or decline in numbers of customers using fuel oil for space heating. However, in the case of fuel-oil sales and deliveries, the variation in weather can be far greater than most any other single variable. By adjusting the actual quantity of fuel oil handled each year to a calculated figure of what would have been handled with median temperature, a good estimate can be made of the over-all growth factor in any local market.

Pipeline deliveries change with the weather . . . To give some specific detail as to order of magnitude of the weather factor in preparing fuel-oil estimates, an example can be given using the influence of weather changes on the deliveries of fuel oil made by Great Lakes Pipeline Co. which serves 19 terminals throughout the Middle West. Fifteen of these terminals have been in operation for two or more seasons. After making proper adjustments for the growth factor at the 15 terminals, it has been determined that the difference in coldness between the 1954-55 season and the 1955-56 season brought about increased fuel-oil deliveries of over 16 per cent. Such a percentage of the volume carried by Great Lakes means that the difference was measured in multiple millions of barrels. This difference in the quantity of fuel oil delivered was due only to the difference in the weather.

Climatic odds for short periods . . . Although there are some planning problems in handling fuel oil that require the use of seasonal figures, many planning decisions dealing with refinery runs, transportation, and storage space are involved with shorter periods. In

each case past data can be tested to determine the climatic odds for the occurrence of any change in the value between that most recent period and the period for which an estimate is being made. The seasonal totals are made up by adding the quantities delivered and sold throughout the shorter periods. For instance, there may be a problem of storage facilities in which it is necessary to know what the climatic odds are for the month of December only. December 1955 was cold in Minneapolis, and the climatic odds are 50 to 6 that December 1956 will be warmer.

Similar information for January and February 1957 are as follows: the climatic odds are only 32 to 24 that January 1957 will be warmer than January 1956. The climatic odds are 34 to 22 that February 1957 will be warmer than February 1956.

Another problem may involve pipeline capacity over a 3-month period. When the 3-month period of December through February is combined and all of the past data are also combined to give readings that are directly comparable, it is found that the climatic odds are 46 to 10 that the 3-month period, December through February, will be warmer than the same period last year.

Specific past example . . . By the end of March every year in Minneapolis, each oil company, along with its dealers and distributors, faces the question of how much fuel oil will be needed for the remainder of the season. At that point, in the 1955-56 season, any company could have availed itself of valuable comparative information completely independent of any specific long-range forecast. In fact, the information was available as far back as early June 1955. In Fig. 2 is shown the entire 56-year array of the combined degree-day totals for the months of April and May at Minneapolis. The location of the total for these 2 months in 1955 was a new extreme in the climatic range for this specific period. There were only 452 degree-days during the 2 months. That can be compared with the median 2-month total of 836 degree-days and the cold extreme of 1,412 degree-days.

Looking ahead to the same period of 1956, it could have been determined that the climatic odds were 55 to 1 that that value would be exceeded in 1956. In other words, there would be considerable confidence that the April-May period in 1956 would be colder than it was in 1955.

Since the median value in degree-days is approximately double the actual total in 1955, a rough estimate can be made that deliveries of fuel oil in the April-May period of 1956 could easily be double what they were in 1955. The 2-month actual total in 1956 was 931 degree-days at Minneapolis. This is approximately double the 452 degree-days for same period in previous year.

April and May of 1955 were also warm months at most of the other 14 terminals then served by Great Lakes Pipeline. It is interesting to note that the comparable deliveries of fuel oil in these 2 months in 1956 for the 15 Great Lakes Pipeline terminals which were in full operation both years were slightly more than double what they were in 1955.

The colder weather and the resulting increased deliveries in April and May 1956 probably was a major factor in holding up fuel-oil prices in that period.

Oversupply may be real problem . . . The contrast in both price and quantity of fuel oil delivered in the Middle West between last winter and the year before is such that without due regard for the difference in weather a very optimistic growth picture is presented. Because some oil companies may expect this "unreal" growth to continue, there is a tendency for an oversupply of fuel oil in the 1956-57 season. The growth in deliveries without regard to the differences in temperatures, accounts for increases of from 15 to 20 per cent at various terminals served by Great Lakes between 1954-55 and 1955-56. If such a growth was projected to continue for the season just ahead, a very large oversupply of fuel oil would result. The number of degree-days required to consume this quantity of fuel oil is well above the maximum climatic range which has been established in the area they serve.

The climatic odds for Minneapolis show a specific indication that temperatures will be warmer. Such high odds do not apply to Chicago or Detroit or New York City. And yet there are other locations where odds for warmer weather are even higher than at Minneapolis. Careful analysis of past climatic data is required for each respective area. When several are served by one pipeline an over-all figure of climatic odds can be obtained by proper weighting of each area in terms of its relative importance in fuel-oil deliveries. Any individual marketing company or a refinery serving either single or multiple areas can utilize climatic odds to help in preparation of estimates of the changes in fuel-oil requirements in the season just ahead.

BOOKS

CHEMICAL MARKET RESEARCH. Edited by Richard E. Chaddock. Published by Reinhold Publishing Corp., 430 Park Avenue, New York 22, 140 pp. $3.

This book devotes nine chapters and seven case studies to organization, personnel, market surveys, literature, field work and reports, as seen by 24 experts in the field—all of them well-known members of the Chemical Market Research Association.

The material covered includes: The Chemical Market Survey, Effective Utilization of the Literature, How to do Effective Field Work, Presenting Market Research Results, Integrating Research and Development with Market Research, Tie-In with Policy Planning and Finance, and The Human Equation.

The case studies cover plastics, synthetic fibers, synthetic detergents, the petrochemical industry, sulfur, paint, varnish, and lacquer and a departmental case study. The book is based on lectures given at Case Institute of Technology and the extension division of the University of Delaware.

THE CONDENSED CHEMICAL DICTIONARY, Fifth Edition by Arthur and Elizabeth Rose. Published by Reinhold Publishing Corp., 430 Park Avenue, New York 22, 1,220 pages, $12.50.

This new edition contains over 30,000 entries, giving data on chemicals, chemical terminology, trade-name products, and related substances. Chemical and physical properties of chemicals and raw materials also are included.

The book contains information on containers, shipping regulations, and safety instructions. It includes new uses of chemicals in nuclear energy, chemotherapy, and other fields of current interest. There are a great many crossreferences.

The information on trade-name and trade-mark products is up-to-the-minute. Many of these items have either just been placed on the market or have just completed pilot-plant stage.

The book is thumb indexed for quick reference.

JOURNAL OF APPLIED RADIATION AND ISOTOPES. Published by Pergamon Press, Inc., 122 East Fifty-fifth Street, New York 22. Paper back, 144 p.

The versatility of radioactive and radiation techniques has led to their use in a variety of specialist fields. This journal is intended to provide a forum for the publication and discussion of these techniques.

More than a dozen reports and papers are included in this first volume. Illustrations, references, equations, and other information is included.

GROUNDING OF INDUSTRIAL POWER SYSTEMS. Published by the American Institute of Electrical Engineers, 33 West Thirty-ninth Street, New York 18. 40 pp. $1.20. Discount of 50 per cent to members.

The book includes four chapters on system grounding, connections of frames and enclosures to grounded systems, the problem of static, and the problem of obtaining low-resistance connections to the earth.

The book was prepared by a subcommittee of the A.I.E.E. Industrial Power Systems Committee, D. L. Beeman, General Electric Co., Schenectady, N. Y., chairman.

Note: The Oil and Gas Journal maintains a book department. Write to the READER SERVICE DEPARTMENT, P. O. Box 1260, Tulsa 1, for copies of the book list. Often books reviewed here may be purchased from this source.

holds as much ammonia as

1,690 tank cars

You could discharge the loaded capacity of a train of tank cars over 12¼ miles long into Phillips Chemical Company's huge aqua-ammonia storage tank at Cactus, Texas. With a diameter of 220 feet and a height of 48 feet, this new tank is the largest in the world used for liquid storage. Liquid is pumped in at a rate of about 250 gallons a minute . . . and yet it takes nearly 37 days to fill this 323,000-barrel-capacity tank.

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If you are faced with the problem of storing liquids or gases, General American has the personnel, skill and experience to serve you. For information, call or write General American today.

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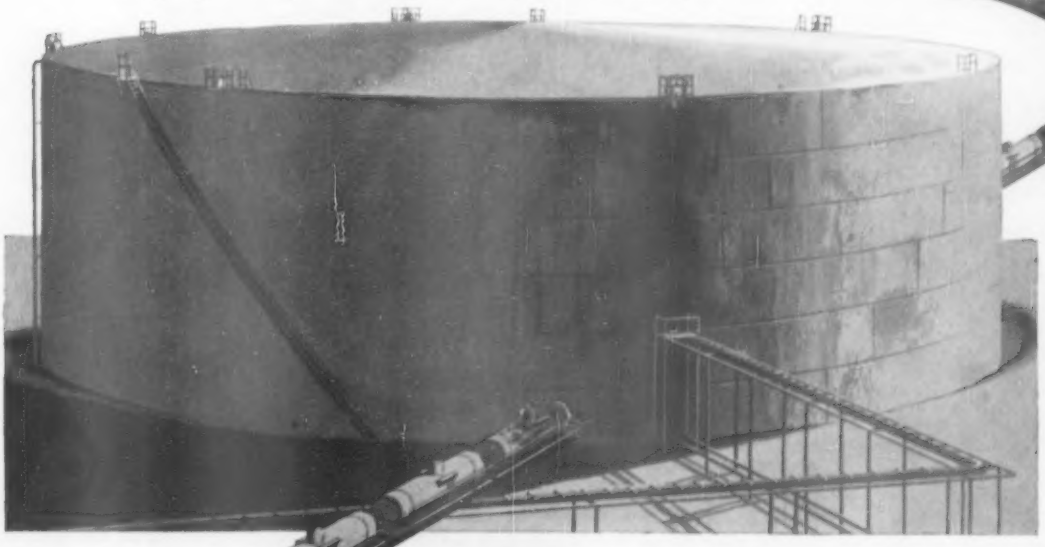

PLATE & WELDING DIVISION

GENERAL AMERICAN

TRADE MARK

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GENERAL AMERICAN TRANSPORTATION CORPORATION

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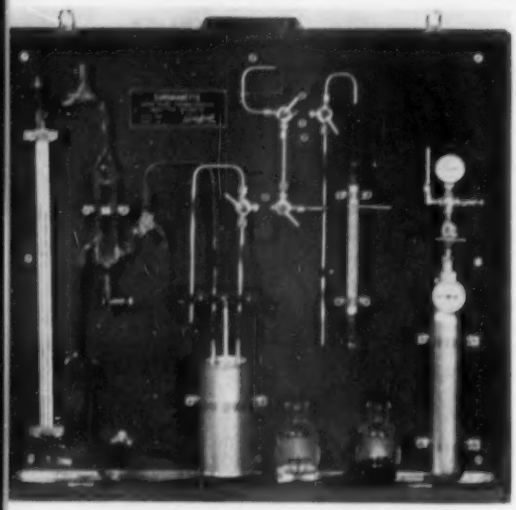


PORTABLE CHROMATOGRAPH, developed by Podbielniak, Inc., weighs only 15 lb. and is completely self-contained.

A special section compiled from papers selected by Journal editors on a new, speedy, accurate hydrocarbon-analytical tool for refining, natural-gasoline, and petrochemical plants

Gas Chromatography

VAPOR-PHASE chromatography is a powerful analytical tool that will augment other methods of gas analysis, and will in some cases supplant them. It's fast, simple, and accurate.

The method is applicable for plant as well as laboratory use, and a number of process-stream applications either have been or soon will be made. Analytical results are available quickly, and operating efficiencies can be improved significantly.

Material for this section was obtained from the paper, The ABC's of Gas Chromatography for Natural-Gas and Gasoline Analysis, presented at Shreveport meeting, N.G.A.A., by A. J. Miller, Phillips Petroleum Co.; and from these papers presented at Los Angeles meeting, C.N.G.A.: (1) Developments in Chromatography, by J. R. Corbin, Perkin-Elmer Corp., Houston; (2) The Role of Column Packing Materials and Carrier Gases, by Don Carle, Beckman Instruments, Inc., Pasadena, Calif.; (3) Sample Introduction, Detectors, and Recorders, by P. D. Singer, Braun Corp., Los Angeles; (4) Establishing Operation Conditions and Techniques, by L. V. Guild, Burrell Corp., Pittsburgh; and (5) Future Possibilities of Gas Chromatography, by W. J. Podbielniak and S. T. Preston, Podbielniak, Inc., Chicago.

The paper, An Automatic Chromatograph for Hazardous Areas, was written for the Journal by Monte L. Parks, Consolidated Electrodynamics Corp., Pasadena, Calif.

. . . For Natural-Gas and Gasoline Analysis—1

GAS chromatography holds great promise for use in the analysis of natural gas and natural-gas liquids. There's little doubt that it will have wide application for plant control, since it offers speed, relatively low cost, accuracy within practical limits, and simplicity of operation.

What it is . . . In distillation, a sample is analyzed by separating a mixture into its components by boiling and taking them off into a receiver, according to boiling-point differences.

In gas chromatography the separation is made by selective adsorption or adsorption of the components of the sample on material such as activated charcoal.

Chromatography is not new. In fact, it got its name in 1906 when this principle was used to separate coloring matter from leaves. The charcoal test, as well as the charcoal plant, are examples of chromatography. Here the charcoal is used to separate the natural-gasoline fractions from the gaseous components.

Analytical Usage

As now used in analysis, there are two common classifications of chromatography: (1) displacement, and (2) elution. Displacement chromatography was the first to come to the attention

Material by A. J. Miller.

Gas Chromatography

of the N.G.A.A. Analysis Committee. Since 1948, 7 liquid samples have been sent to over 120 different laboratories, representing research, commercial, and plant control.

Over 1,000 results have been correlated and the data have provided information on existing methods as to expected accuracy, speed, degree of analyst skill and training required, etc.

Displacement . . . In 1954, an analysis was received in the N.G.A.A. test program that was run on an apparatus, now classified as displacement chromatography. In this method, the sample, which may be either liquid or gas, is adsorbed on activated charcoal contained in a tapered tube. A stripping vapor is then introduced at the bottom of the tube and causes the components of the sample to be selectively removed at the top of the column, with the lightest adsorbed component being removed first.

The components are identified by passing the outlet vapor through a cell that measures thermal conductivity and then into an evacuated receiver for measurement of volume. This 1954 result attracted attention because in accuracy it rated within the top 10 analyses, and the time required for the analysis was only 1 hour and 20 minutes.

Apparatus utilizing the principle of elution chromatography appeared on the market by 1955, and interest soared as technicians began to realize the sharp separations possible, the speed, reproducibility, and the relatively low cost and simplicity of operation of this method. By early 1956, developments in apparatus and techniques were being reported in rapid-fire order.

Elution . . . In this type of chromatography, the sample is introduced into a column of selective adsorbent. The stripping gas, usually called the carrier gas, flows through at carefully regulated conditions of flow rate, pressure, and temperature. The material in the column tries to hold the components of the sample while the stripping gas tries to pull them or wash them along through the column.

The result is that the components travel through the column at different rates of speed, depending on their affinities for the packing material. The outlet gas, or eluent, will consist of the carrier gas and then the separated components, successively in the order of their speeds through the column. A continuous record of the thermal conductivity of the eluent gas on a strip chart indicates the identity and amount of each component by rise and fall of the curve.

Some instruments on the market now provide electronic integration of the areas under the curves for computing the percentage of the components. Another method in use is the calibration against standards so that mole per cent may be read directly from the chart by the peak height of the curve for each component.

Natural-Gasoline Applications

Almost any gas or volatile liquid can now be separated into its components by elution gas chromatography, by proper choice of the many available packing materials in use for making these separations. Natural-gas and gasoline samples have been easily and rapidly separated into their hydrocarbon components, including many isomers, heretofore only difficultly separated, and nonhydrocarbon constituents such as nitrogen in natural gas.

Available data indicate that these typical gasoline plant streams may be analyzed and computed within 10 to 30 minutes. This is only a fraction of the 4 to 8 hours required for these analyses by low-temperature distillation.

Complete cost for elution chromatographic apparatus ranges from about $1,500 to $3,000 for most models now on the market, with some higher prices for research models and lower prices in the $500 range for a recent portable type.

The N.G.A.A. Analysis Committee as yet has but meager data on accuracy. On mixture No. 7, which consisted of natural-gasoline components from ethane through normal heptane, one result by elution chromatography was received. Analysis time was 20 minutes and its accuracy rated with the best. In this case, the computation was made by comparing the curves with calibrated standards.

Plant use . . . The chromatograph's features of speed, low cost, and simplicity of operation bid high for use in plants, or for on-the-spot analyses. This would provide the plant operator with up-to-the-minute information on percentage recoveries of all components, determine small amounts of recoverable components in the residue gas streams, the degree of stripping of the lean oil, etc. The effects of changing plant variables, such as balancing oil rates to absorbers and reabsorbers, could be checked almost instantly for optimum use of available oil circulation.

Operation of deethanizers, or other fractionators, could be guided or controlled by product composition, allowing closer control of undesirable light components in the kettle and reducing loss of desired components in the overhead. Instruments are already on the market that will automatically sample, by time cycle, and analyze major streams in the gasoline plant, such as inlet gas, residue gas, recycle, and the plant products.

Besides the dividends of increased plant efficiency and greater recovery, the operator would gain much knowledge about such matters as daily and hourly variations in the inlet gas contents and the causes of low production. Of interest for plant testing is a portable instrument, weighing only about 15 lb., that was recently placed on the market.

When speedy and dependable analyses become proved by wide use of chromatography, it would be expected that product specifications on gas and liquids may shift from secondary measurements such as heating values and weathering tests to clearly defined composition limits.

. . . New Developments—2

VAPOR-PARTITION chromatography has become increasingly important as a standard analytical tool of the laboratory in the last few years. The very nature of the method is desirable because the initial instrument cost is small and interpretation of data is considerably simpler than any other similar analytical instrumentation.

Instrument maintenance, which poses a definite problem in most analytical instruments, is largely reduced by the astonishingly simple electronic circuits within most commercial chromatography instruments.

Vapor-partition-chromatography equipment was first commercially available in this country in the early spring of 1955, and now, about 1½ years later, there are about 12 or 14 manufacturers commercially producing instruments in this country. This tremendous rate of growth has surpassed by far production of any other similar analytical instrument and, obviously, this is only the infancy period of vapor-partition chromatography.

From material by J. R. Corbin.

Several manufacturers now produce process monitoring chromatography devices, and others are working on large-sized instruments (with columns up to 2 ft. in diameter) for preparative work.

A new instrument may now be used to temperatures in the range of room to 225° C. This is an increase of 75° C. over previous models. High operating temperatures are very desirable, but only if adequate sensitivity is maintained, because sensitivity falls rapidly as operating temperature is increased.

A sharp increase in sensitivity over the previous model has been achieved by the use of new high-resistance thermistor beads and a modified circuit. These new beads operate at 6 to 7 volts.

A capillary dipper system, similar to the mass spectrometer liquid sampler for precise reproducible injection of liquid samples, is now available. This capillary dipper system permits introduction of liquids reproducibly to the order of ± ½ per cent, as well as provision to inject extremely small samples (¼-1 microliter) when highest component resolution is required.

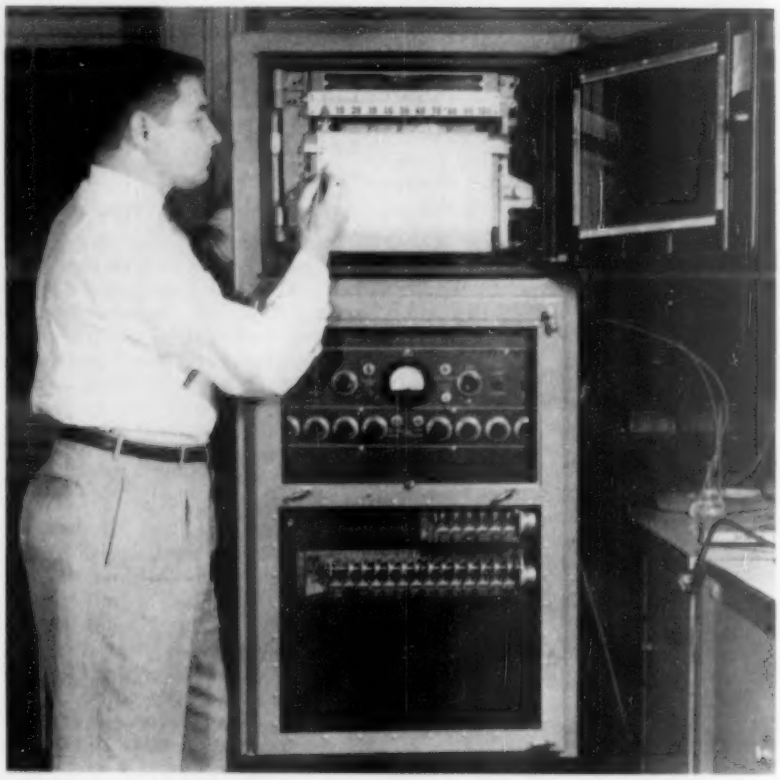
Peak identification . . . An important area of interest in vapor-phase chromatography is the identification of eluted peaks. Identification may be accomplished directly from reference materials if temperature and carrier gas flow are controlled so as to provide reproducible retention times.

Several English workers have begun to express peak locations for a given column material in terms of retention ratios, that is, the expression of retention time for a number of components as ratioed to a known reference material. This method of peak identification will, undoubtedly, spread until it becomes as valuable a tool as adsorption spectra or cracking patterns. By using a prepared table such as this, an operator will be able to predetermine band overlaps as well as peak identification for a chosen column material.

The most obvious method of identification of eluted components, however, is the trapping of "peaks" and determination by other means, such as infrared, ultraviolet, or mass spectroscopy.

Conclusion

Vapor-phase-partition chromatography offers excellent resolution between most similar boiling components, and these trapping techniques will, undoubtedly, prove extremely valuable as a means for obtaining high-purity materials that were previously difficult or impossible to obtain. These high-purity materials will enable spectroscopists to obtain adsorption spectra and cracking patterns unencumbered by trace impurities that previously caused misleading interpretation.



NEW PROCESS GAS CHROMATOGRAPH is being checked out at the plant of Beckman Instruments before shipment. The instrument analyzes gases by directly sampling a process stream.

. . . Role of Column-Packing Materials, Carrier Gases—3

COLUMN-PACKING material and carrier gas must be selected carefully before the full potential of gas chromatography is realized.

Carrier Gases

The choice of the carrier gas is much simpler than the choice of column material. The carrier gas must be selected from a relatively small group of gases, while there is virtually an infinite number of possibilities for filling a column.

High thermal conductivity. All commercial instruments employ thermal-conductivity cell detectors. Sensitivity is increased by a carrier gas with high thermal conductivity. Near-equal thermal-conductivity difference between sample components and carrier gas is desirable so that all components give similar concentration-detector signal relation. This is accomplished only with gases of highest thermal conductivity.

Low diffusion rate. This becomes important only with very low carrier gas flow rates. Here column resolution is decreased because of gas phase remixing. When flow rates are greater than about 20 cc. per minute this effect is minor.

Chemical inertness. It is obvious that sample or column material should not react with the carrier gas. Detector life will be reduced if the sensing elements are reactive with the carrier gas.

From material by Don Carle.

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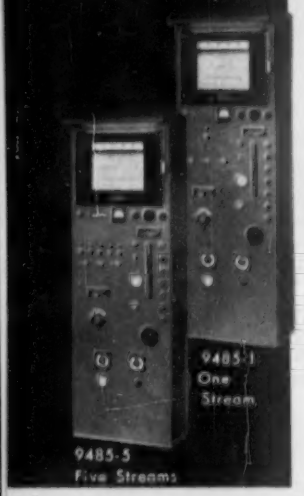

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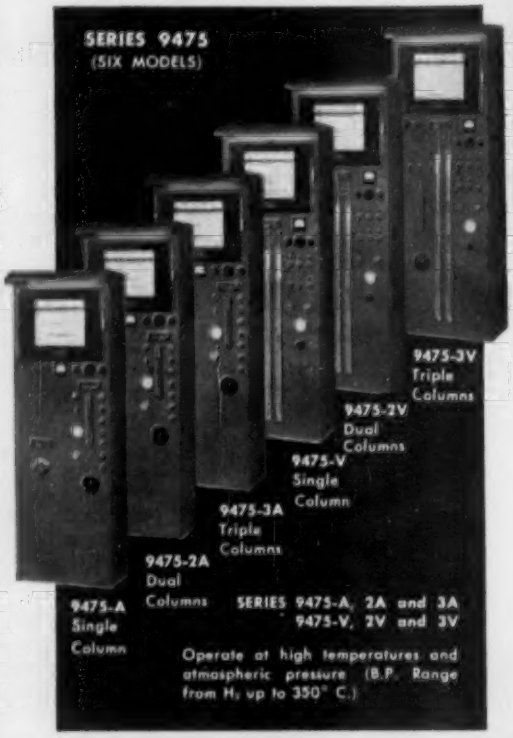

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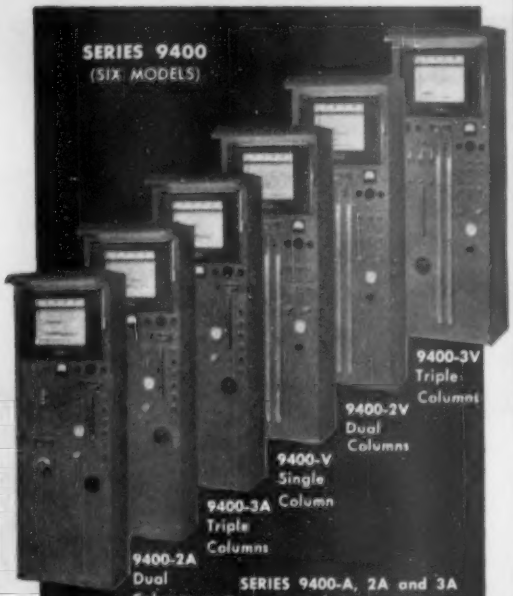

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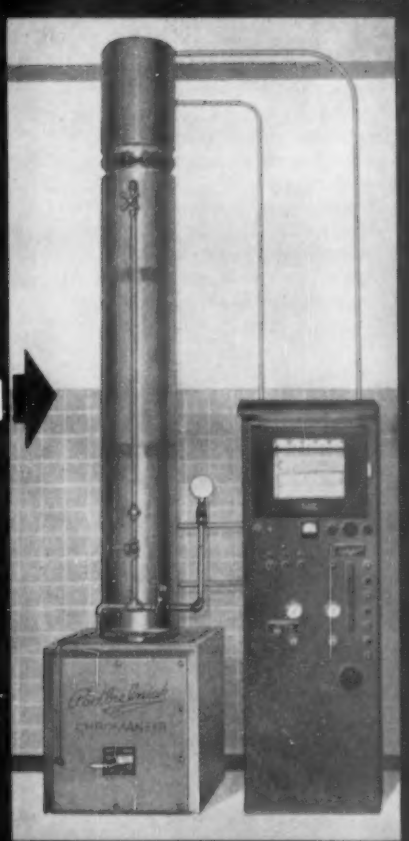

Podbielniak Vapor-Phase CHROMANEER PLANT—Is used for the industrial purification of liquid or gaseous materials produced in small quantities. This method of separation gives a product of *extreme purity*, regardless of the boiling point of contaminating materials, with continuous automatic operation.

APPLICATIONS

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SPECIFICATIONS

1. COLUMNS: 2" to 4" diameter, 20 feet and up in length.
2. CAPACITY: 10 to 25 cubic feet of a gaseous product per day. Capacity varies with purity of charge and length of time cycle.
3. TEMPERATURE OF OPERATION: Columns thermostatted for operation at any temperature from 25° C to 200° C, as required for the particular separation to be made.
4. INSTRUMENTATION: Composition of exit gas monitored and continuously recorded.

WRITE FOR BULLETIN A-15 FOR COMPLETE SPECIFICATIONS.

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Low molecular weight. Elution rate is proportional to volumetric flow rate. At equal flow rates column pressure drop is greater with nitrogen than with helium. Carrier-gas velocity is decreased by this higher pressure in the first portion of the column. In addition to increased analysis time, sampling problems are more difficult the higher the column pressure drop.

Safety. Particularly in routine analysis it is preferable to use a carrier gas that does not form explosive mixtures with air.

Helium. Helium has been accepted by most workers as the best general-purpose carrier gas. In most work helium offers the best compromise of carrier-gas properties. The sensitivity with helium approaches that with hydrogen. Helium is completely inert towards sample, column, and detector. There is no explosion hazard. The diffusion rate is high, hence the flow rate should be somewhat higher than with other gases.

A cylinder typically lasts several weeks in analytical work, so that the cost is nominal. Local shortages in the United States have been a problem in some cases, but this appears to be only a temporary problem.

Hydrogen is the best selection on a sensitivity basis. Hydrogenation of some samples may be observed. Hydrogen is a poor choice with untrained people because of the explosion hazard. In addition, diffusion in the gas phase is high. Hydrogen is best selected for specific research problems only.

Nitrogen carrier provides less sensitivity than helium. Somewhat higher resolution, however, is possible. Helium used with a longer column usually serves to offset this advantage.

Argon has a relatively low diffusion rate and could be used to gain increased resolution with a specific research problem. Sensitivity to most components would be low.

Air is particularly valuable in air-pollution studies. The instrument is thus made insensitive to the main sample components and extremely large samples may be used.

Methane. Where trace analysis of natural gas is the problem, methane carrier gas provides insensitivity to the main component and the use of large samples. Nitrogen-methane resolution is difficult with a partition column but with this technique traces of nitrogen are easily detected.

Carbon dioxide. The gas chromatograph effluent may be bubbled through sodium hydroxide solution and collected directly without the necessity of cold traps.

It can be concluded that while a large majority of gas chromatography analyses are best done with helium as carrier gas, there are many cases where some other gas would extend the power of this new tool.

Column-Packing Materials

Until recently, the selection of a column material for a particular analysis was usually a lengthy task. The factors of column performance are now becoming more well known. Columns of wider application are being developed. Instrument manufacturers offer one or more standard columns with their instruments.

Adsorption columns . . . The materials used for adsorption columns include the classical adsorbents such as activated charcoal, alumina, and silica gel. Each of these materials has been used with considerable success with the lower-boiling and so-called "fixed" gases. For very low-boiling gases adsorption columns generally are to be preferred to partition columns.

Sample components of increasing boiling points do not in general give good results on adsorption columns. Typical adsorption isotherms are non-linear and hence tailing of peaks is observed. Partition columns are generally preferred for all except very low-boiling samples.

Molecular sieves (Linde) are another series of promising column materials. They are best grouped with adsorbents although simple adsorption does not explain the mechanism involved.

The preparation of adsorbent columns may be difficult to standardize. The same absorbent may have widely different activity depending on its history. It is preferred to start with the best standardized materials available. Size classification with adsorbents is less critical than with partition columns.

Wet screening removes fines so that pressure drop may be reduced. Drying should be standardized at a sufficiently high temperature so that all adsorbed water is removed since drift and activation changes result from removal of traces of water in the instrument.

Liquid partition columns . . . Partition columns are prepared with a high-boiling liquid coating on a finely divided inert solid. The result of passing a carrier gas and a sample over this material can be explained in terms of solution phenomena. The sample dissolves in the partition liquid and is swept along by the carrier gas at a rate proportional to its vapor pressure over the solution.

Efficiency of separation can be described in terms of the **separation factor** and the **number of theoretical plates.** The separation factor is the ratio of two retention volumes based on peak maxima—it does not define the degree of overlap of two peaks. A theoretical plate is defined as a distillation. The number of theoretical plates is a measure of the degree of separation, that is, it is related to peak shape.

Usually these terms are used only qualitatively since calculation is difficult and inaccurate. The aim is to find a set of conditions where all components are resolved to the base line. In addition, time of analysis is shortened where the separation factor is kept to the minimum for complete separation.

Inert solid. A wide variety of materials have been used as support for the partition liquid. The most successful and most used solids have been some form of diatomaceous earth. Diatomaceous earths typically have surface areas of a few square meters per gram yet the pore structure is large compared to molecular dimensions.

This type of structure allows freedom to the flow of carrier gas and sample vapor, yet the partition liquid is spread in a very thin film on the surface. This provides fast equilibration of gas and liquid phase.

Size classification is important for best results. In general resolution increases with decrease in particle size but little is gained below about 80 to 100 mesh. Pressure drop in the column increases rapidly with decreasing particles. High pressure drop causes a carrier-gas velocity gradient over the column length thus precluding optimizing carrier gas flow rate.

In selecting the best particle size to compromise the above effects, a narrow range of particle size is preferred. For columns in the range of 6 to perhaps 18 ft. in length, 42-60 mesh has proved to be optimum. Exhaustive wet screening is recommended to keep pressure drop to a minimum.

The inert solid should have sufficient mechanical strength so that new fines are not formed in preparing and using the column.

The solid should be completely chemically inert to the sample and partition liquid.

Coating the solid. The simplest method of uniform impregnation with the partition liquid employs a volatile solvent. Methylene chloride has proved very satisfactory for this purpose. A solution of the partition liquid and the solvent is prepared in a quantity approximately equal to 80 per cent of the volume of the inert phase.

The solid is added slowly to the solution so that wetting is complete. The mixture is then spread in a thin layer

and allowed to air dry. The column is filled and the last traces of solvent are removed by elution.

The quantity of partition liquid is important. Retention volumes depend somewhat on the quantity of high boiling liquid. For general work 35-45 g. of liquid to 100 g. of solid is recommended. Where it is desired to increase the speed of analysis, somewhat less partition liquid may be an aid. A thinner liquid film can equilibrate with the gas phase more rapidly.

Partition liquid. Selection of the proper partition liquid is probably the most challenging and important phase in gas chromatography. It is not yet possible to predict exactly the result with any one liquid. However, the number of trials can be reduced by considering the partition process. It is first a solution phenomenon and reference to solution theory will prove helpful.

The vapor pressure of the partition liquid must be low enough that it will not be removed from the column. A boiling point about 250° C. above column temperature is usually satisfactory.

The viscosity should be low for rapid diffusion of sample; however, this must be a compromise with boiling point.

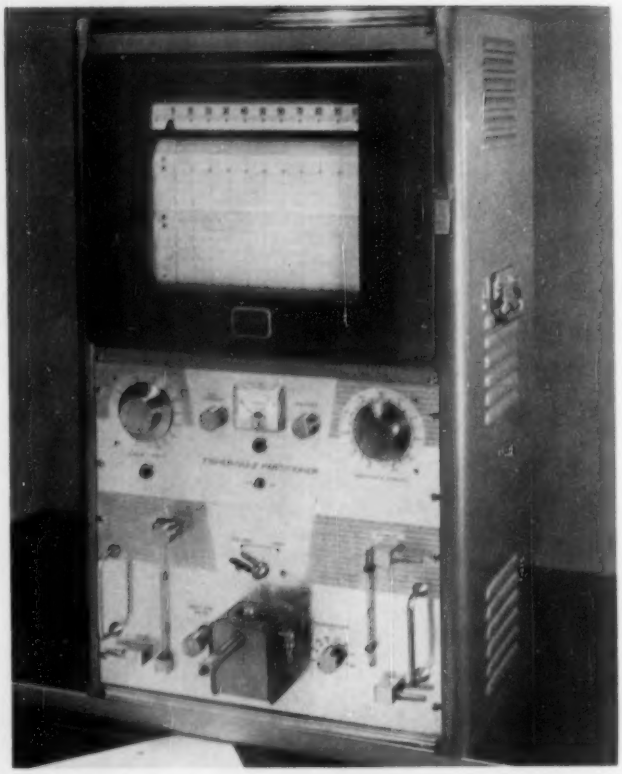
The liquid must be chemically stable in the presence of the sample at the operating temperature.

The retention time or volume of any component is a measure of the vapor pressure of this component over the solution of partition liquid. The distribution coefficient of a component between the partition liquid and carrier gas frequently is used as the quantitative expression of vapor-liquid affinity. A nonpolar sample will be eluted from a nonpolar partition agent with the component in order of their boiling points.

A polar component is eluted from a nonpolar partition agent faster than its boiling point predicts. This can aid in many separations. Chloroform, because of marked polarity, is completely separated from carbon tetrachloride on only 2 ft. of a standard hexadecane column. When octyl sebacate is used as the partition agent chloroform is eluted after carbon tetrachloride.

The polar partition agent and chloroform interact (by hydrogen bonding) to greatly increase retention volume. By using this type of interaction it is possible to virtually tailor-make some separations.

A good example of polar interaction is the use of benzyl ether for hydrocarbon separations. Benzyl ether delays the elution of unsaturated hydrocarbons as compared to similar saturates.



NEW SAMPLING SYSTEM for chromatography apparatus is shown mounted below the recorder. The device works for both liquid and gas samples.

. . . Sample Introduction, Detectors, and Recorders—4

THERE are a number of methods for sample introduction in chromatography. All of these techniques have some merit, depending on the application.

Some of these methods are: (1) gas injection by a syringe; (2) liquid injection by a syringe; (3) carrier gas is passed through gas bulbs containing the sample; (4) gas sampling valves; and (5) capsules containing liquid are put into the system and crushed.

The injection of gas samples with a regular syringe can be done in two ways. The sample can be charged into the system against the back pressure of the column, or the back pressure can be released to charge the sample. If the column back pressure is significant, it is possible to lose the sample trying to push against this pressure.

Liquid samples . . . These are injected into the gas stream by three types of syringes, with and without back pressure of the system.

From material by Peter D. Singer.

1. A regular syringe, which will maintain a small cavity where the needle is connected to the syringe. This cavity can cause some trouble especially when the syringe is not cleaned after use.

2. The microsyringe, which enables the operator to measure very small samples quite accurately and inject as with regular syringe.

3. A special syringe with a stainless-steel plunger and threaded stem. A small special adapter is calibrated for volumes from 0.005 to 0.02 ml. of liquid.

When using the gas sample bulbs the carrier-gas stream is controlled with stopcocks. The sample bulbs are connected into the system and the sample is picked up by the carrier gas.

For stream and sample cylinders a sampling valve can be employed which puts a sample into the carrier-gas stream. This type of valve is used for gas samples only and in most cases the volume of sample is constant.

In the capsule technique a liquid

sample is put into a capsule and weighed. This capsule is placed into a chamber where the carrier gas can pass through and sweep the sample into the system. After the sample is put into the chamber, the capsule is crushed to allow the sample to vaporize. After vaporization, the sample is picked up and carried through the system.

New sampling device . . . Fig. 1 shows a new sampling device for both liquid and gas samples. The top drawing shows the valve which is connected into the system where the stopcock closes the system from the atmosphere. The helium passes into the side of the long tubing and then into the column through the orifice. While the stopcock is closed the system is under its normal back pressure.

The stopcock and the tube with neoprene O-ring are located outside of the air bath, and the orifice and side joint are in the air bath.

The small gas-and-liquid pipettes are designed to collect the liquid samples by capillary action. The gas samples are purged through the sample volume portion before it is introduced to the system.

The procedure to charge a sample is to first open the valve just enough to allow helium to purge out all air in the open tube. After the pipette is filled, it is then forced into the open tube until there is a seal between the O-ring and the large portion of the pipette. The valve is then opened completely, and the pipette is pushed through the valve until the point is forced into the orifice or seat.

The helium comes into the tube from the side, passes through the small opening on the side of the pipette, and carries the sample into the column. The gas pipettes work the same way but a larger volume can be used.

The liquid pipettes range in size from 0.002 to 0.5 ml., while the gas pipettes will have a range from a few tenths of a milliliter to 50 ml.

To test the reproducibility of this new sampling system, 15 samples of a mixture of isopentane and n-pentane were analyzed. These samples were introduced using a pipette having 0.002-ml. capacity. The peak heights were all within ±0.4 per cent.

Detecting System

The most popular detector is the thermal-conductivity cell. There are two general types of thermal-conductivity cells—the hot-wire and the thermistor types.

The cell used in one new chromatographic instrument, the Fisher Gulf partitioner, is the diffusion types, employing two matched thermistors. The gases flow straight through a stainless-steel block, and the thermistors are placed ¼ in. out of the stream. These thermistors are very sensitive and if they were in the gas stream, they would be extremely responsive to flow. The response time is approximately 2 to 3 seconds.

There are three conditions that must be stable in order to permit use of thermistor cells. They are: a constant gas flow, constant current input, and constant temperature in the air bath. Of these three, the flow rate is the least critical.

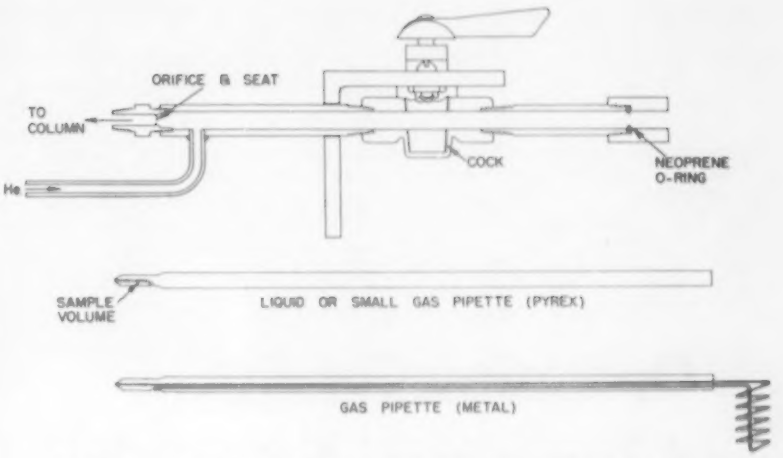
Recorders

The recorder used in the partitioner is a strip-chart recorder with a 3-second pen speed for full-scale deflection. The recorder is equipped with three chart speeds of 15, 30, and 60 in. per hour.

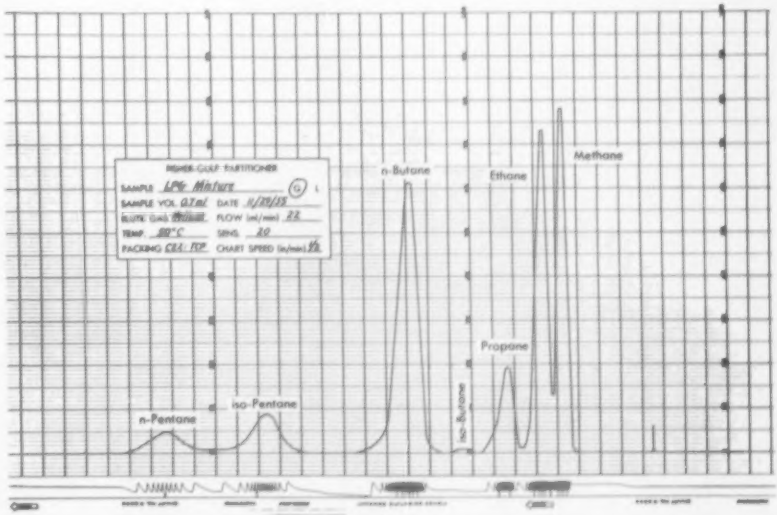
The most important feature of this recorder is the automatic integrator which is built into it and records with a second pen the area of the peak recorded. The second pen records pips on the paper that are proportional to the area of the peaks and they can be converted into weight or mole per cent of each component.

This integrator works on the ball-and-disk principle. The disk is driven by a 5-r.p.m. synchronous motor. Located between the disk and the output shaft are the small steel balls. A cam on the recorder slide wire shaft is linked to a sliding shaft which controls the position of the small balls.

The sliding arm of the integrator is



LIQUID AND GAS SAMPLES can be handled by this sampling device. Fig. 1.



TYPICAL CHROMATOGRAM for an L.P.G. mixture. When a trace of some component is suspected, the sensitivity can be set as low as is desirable for the major components and increased to as high value as is desirable to detect the trace components. Sensitivity changes linearly, and a direct ratio of the two settings can be applied when counting up the integrator score to calculate the percentage of each component in the sample mixture.

adjusted for zero output when the recorder base line is zero on the chart. The ball is then at the very center of the disk. As the thermal-conductivity cell detects a component, the recorder pen shows a deflection and also slides the ball out toward the edge of the rotating disk. This increases the speed of rotation of the output shaft, in proportion to the chart pen deflection. The output can range from 0 to 2.4 times the input, or 12 r.p.m.

A cam with nine small teeth and one large one is mounted on the integrator output shaft. With the integrator pen linked to this cam, nine small pips and one large or long pip are recorded for each rotation. The enlarged tenth pip makes it easy to count up the integrator score, even when the pips are crowded together. The more counts per peak the more accurate the analysis will be.

. . . Operating Conditions And Technique—5

A SERIES of studies of the controllable variables in gas and vapor chromatographic apparatus has yielded these results:

- **C-22 firebrick** is the best partition support in current use with the most practical particle size about 30 to 50 mesh.
- **The most suitable column dimensions** for general applications are approximately 6 mm. inside diameter and maximum lengths to about 20 ft.
- **Hydrogen and helium are the preferred** eluents at a rate for these column dimensions of approximately 50 to 60 ml. per minute, although nitrogen may yield a slightly higher resolution.
- **Sample sizes** should be of the order of .03 to .05 ml. of liquids and 1 to 2 ml. of gas phase samples.
- **The detector-cell temperature** should be maintained no less than 100° C. below the boiling point of the highest component in the sample. Precautions should be observed in heating the column to be sure that partition liquid is not lost.

Column size . . . The sample size that can be suitably analyzed in any fractionation column is a function of the column diameter. The most satisfactory column diameter based upon our experience and that of other workers is approximately 6 mm. inside diameter. Sample volumes of the order of .01 to .03 ml. liquid can easily be handled by this diameter.

The efficiency of fractionation columns is approximately proportional to the column length. Increasing the column length improves resolution. It is not a linear function of length, and an optimum length may be reached beyond which no further or little improvement in resolution occurs.

Column length was varied in tests on the separation of C_4 hydrocarbons on dimethyl formamide with C-22 firebrick carrier. The improvement in separation from the 3-ft. to 8-ft. column was very marked. A further improvement occurred with a 16-ft. column and then very little improvement was noted with the use of a 24-ft. or even a 40-ft. column. The optimum length for maximum efficiency was approximately 18-24 ft.

From material by L. V. Guild.

Column temperature . . . The greatest effect on resolution of any variable in gas chromatography is the column temperature itself. Small changes in temperature will yield widely differing effects on resolution. In the separation of ortho and para xylene, increasing the temperature from 65° to 100° C. showed a gradation in the resolution from nearly complete resolution to almost no separation.

A good rule of thumb for preliminary settings for the purpose of establishing the analysis technique is to set the temperature such that the vapor pressure of the liquid to be separated is approximately 100 mm.

The use of independent detector and column temperature control has several advantages. Temperature may be changed during an analysis. The stabilization of the detector is more critical and requires a longer time than the stabilization of the columns. Thus, it is possible to change columns and column temperatures rather easily when this scheme is used. Either columns or column temperatures can be altered and analyses resumed in 15 to 20 minutes.

Temperature Limits on Partition Liquids

Another column temperature consideration lies in the limits to which a partition liquid can be heated. When dealing with high-boiling materials, there is a tendency on the part of an operator to utilize partition agents beyond the temperature at which they are suitable.

In our laboratory we never use a partition agent above a temperature which will yield over 0.1 mm. vapor pressure and only use the column for short periods at this temperature. It is much better never to exceed .03 to .05 mm. vapor pressure.

The detecting element is also extremely susceptible to temperature variations, regardless of whether a thermistor type of element or a metal filament is used. Control must usually be held within at least .05° C.

Eluent . . . The eluent gas ordinarily chosen has a thermal conductivity which differs widely from all components in the sample. Based upon this consideration alone, hydrogen or helium is most suitable. However, that nitrogen yields a slight increase in column efficiency over hydrogen. Due to the higher sensitivity, hydrogen or helium is widely used in this country.

Hydrogen has the advantage of the lowest pressure drop and with suitable precautions may be handled quite safely. One convenient way is to pass the hydrogen into a flowing stream of air to reduce the hydrogen below the explosive limit.

Not only does helium have a higher pressure drop, but also due to a higher temperature coefficient of viscosity the pressure drop increases more rapidly with increase in temperature. Thus, the pressure drop with helium is about 2¼ times the pressure drop when using hydrogen.

The effect of increased pressure drop when increasing the column temperature can be reduced to an insignificant value by maintaining the pressure across the needle control valve to a rather high level of the order of 80 to 100 psi.

Too low or too high a flow rate yields poor resolution and rates of the order of 40 to 60 ml. per minute are desirable.

Sample size . . . For best resolution of iso and normal pentane, liquid sample size should be maintained below about .03 to .05 ml. for column diameters of 0.5 to 0.6 cm. Samples of .01 to .02 ml. or less are preferred for very close-boiling components.

Of course, when dealing with trace components it is often desirable to use a much larger sample and if the boiling-point spread of the traces is sufficient, quite large samples can be used to obtain more accurate analysis of them. In fact, the number of components is a large factor in determining the actual sample size. The more the components generally the larger the sample size.

The column temperature is determined by the sample itself. The detec-

Announcing Three New Classes

on Vapor Phase Chromatographic Techniques

Podbielniak Institute

CHICAGO, ILLINOIS

Annual Schedule of Eight Sessions for Two-Week Periods

SEPTEMBER 24, 1956*	LOW, HIGH TEMPERATURE AND VAPOR PHASE CHROMATOGRAPHY
NOVEMBER 5, 1956*	LOW, HIGH TEMPERATURE AND VAPOR PHASE CHROMATOGRAPHY
DECEMBER 3, 1956*	LOW, HIGH TEMPERATURE AND VAPOR PHASE CHROMATOGRAPHY
JANUARY 21, 1957*	LOW, HIGH TEMPERATURE AND VAPOR PHASE CHROMATOGRAPHY
FEBRUARY 25, 1957	**EXCLUSIVELY VAPOR PHASE CHROMATOGRAPHY**
APRIL 10, 1957	**EXCLUSIVELY VAPOR PHASE CHROMATOGRAPHY**
MAY 20, 1957	**EXCLUSIVELY VAPOR PHASE CHROMATOGRAPHY**
JULY 20, 1957*	LOW, HIGH TEMPERATURE AND VAPOR PHASE CHROMATOGRAPHY
SEPTEMBER 24, 1957*	LOW, HIGH TEMPERATURE AND VAPOR PHASE CHROMATOGRAPHY

*Two-week period—First week distillation methods; Second week vapor phase chromatographic methods.

Due to the increasing demand by industry for analysts trained in the techniques of vapor phase chromatography, we are pleased to announce the addition of three *NEW* classes to our yearly training program on analytical methods. The rapid acceptance of gas chromatography in all analytical laboratories has created a need for a training course devoted exclusively to the operating techniques, theory and application of this new method.

The three newly scheduled courses will be devoted each year *exclusively* to the techniques of vapor phase chromatography. The present courses are intended to share the "know-how" gained through intensive research and development in gas chromatography. The training schedule offered is a balanced combination of theory and practical application packed into a two-week intensive training course strictly restricted to men in industry.

The use of gas chromatography as a laboratory analytical method will be treated comprehensively, as well as its role in the field of testing of gases, and as a process stream analyzer. The problems encountered in various applications will be discussed together with accepted or suggested solutions.

Additional classes will be announced as they are added to the curriculum.

Write for course outline and application blank

School Brochure

Mailing Address: 341 E. Ohio St.
Chicago 11, Illinois

tor ambient temperature should be maintained as low as possible without danger of condensation. Thermal conductivity detectors are inherently more stable at lower temperatures.

From vapor-pressure considerations it can be shown that with reasonable sample sizes and eluent flow no condensation can occur if the detector temperature is 100° or less below the boiling point of the highest boiling component. This can safely be done as long as the properties of the partition agent are known and the temperature of the column is maintained such that the partition agent cannot be driven from the column.

Interpretation of Results

Qualitatively establishing the identity of components from gas-chromatographic analyses is ordinarily not difficult where well-known samples are analyzed since the analyst has some knowledge of the composition. However, gas chromatography can also be a useful qualitative tool from consideration of the retention time of the material in the column.

The qualitative analysis of completely unknown samples by gas chromatography does require calibration with known compounds. The retention time of various compounds can be easily obtained and these need not be pure since separations will yield a pure peak of the major component. Where completely unknown materials are analyzed and pure suspected compounds are not available, then it may be necessary to resort to the collection of cuts from the instrument and make further analysis by mass spectrometer or spectrographic identification.

However, in general with some knowledge of the sample and from the materials generally available, adequate identification can be obtained.

1. **The use of standard mixtures of known composition.** This method depends upon calibration of the instrument with mixtures whose compositions are accurately known. A measured quantity of standard is inserted into the instrument under set instrument conditions and the analysis made. The same volume of unknown is then inserted and analyzed. No change in the cell temperature or the eluent flow can be made after the standard has been analyzed.

The area under the curve for any component in the unknown mixture is then directly compared to the area under the curve in the standard. The method has its highest degree of accuracy when the standard has a composition as close as possible to the composition of the unknown. Where the standard is known with a high degree of accuracy, the reproducibility of the determination is the same as the accuracy.

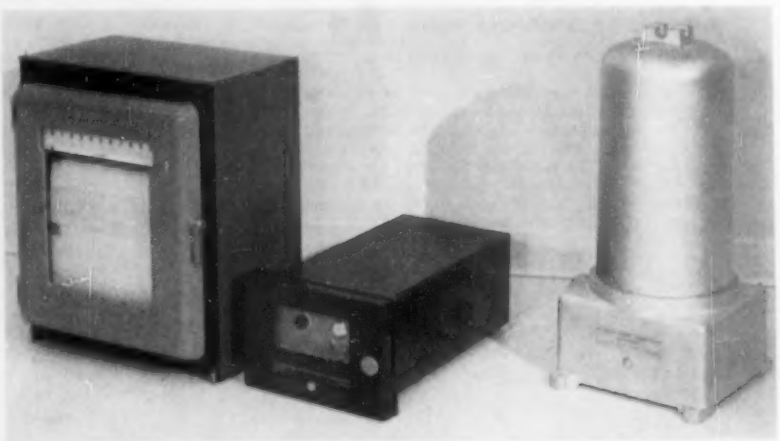
It is very applicable to routine analyses where a large number of determinations are to be made. When the compositon of the standard is known within close limits, this method is capable of very high accuracy.

2. **The second method** is to pass a definite volume of pure compound through the column for each component present, determine the area under the curve and compare to the area under the curve of the sample. This method is most applicable where the interest centers in only one or two components or for a a very few analyses. The calibration becomes quite cumbersome for a multicomponent mixture or for many samples.

3. **The third method** involves determining the area under each component, correcting each area for the difference in thermal conductivity and totaling this corrected area to give a total analysis area. A factor is necessary to correct for the difference in the thermal conductivity of each component.

Very often a close approximation can be made without a correction factor for the difference in thermal conductivity. For similar compounds the error becomes very small if the differences in thermal conductivity is disregarded.

4. **In the fourth method,** internal standard, a known amount of pure compound is added. The areas of the components are then compared to the area under the internal standard. In using this method it is necessary to first blend a known weight of standard with a known weight of sample. Determine the area of each. Then the moles of the relative areas can be calculated. The method is used primarily for liquid samples.



NEW CHROMATOGRAPHY APPARATUS consists of two units, the analyzer module and the control module. Analyzer is housed in an explosionproof container. Fig. 1.

. . . An Automatic Instrument For Hazardous Areas—6

A CHROMATOGRAPH designed for plant use must be rugged, must provide accessibility of most frequently serviced components and must be completely safe for operation in areas where dangerous accumulations of flammable vapors are possible.

One of the latest chromatographs is shown in Fig. 1. This instrument consists of two units: the analyzer module and the control module. The analyzer unit is housed in an explosionproof container of 2.5 cu. ft. in volume and which weighs 100 lb. This unit is safe for operation in hazardous areas designated by the Class I, Group D classification, and contains the inlet system, column, detectors, and flow regulator (Fig. 2).

Material by Monte L. Parks.

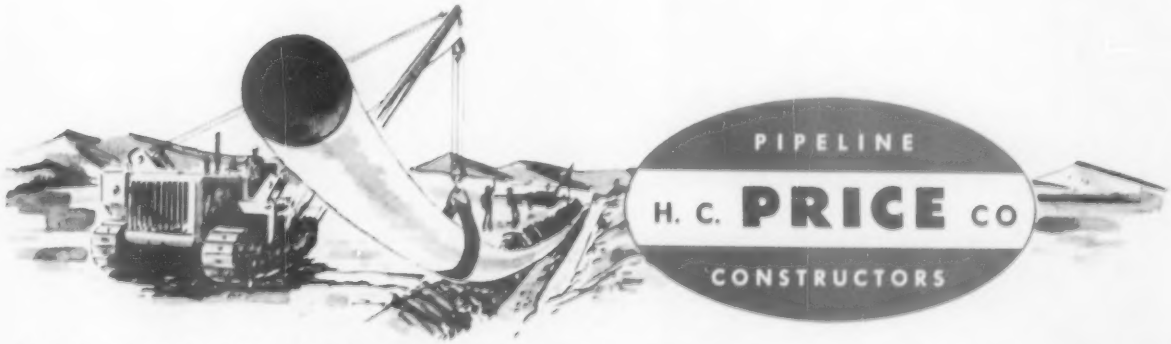
Analyzer . . . The analyzer consists of two sections: The upper section contains the column, detectors, and sample inlet valve. This section may be thermostated at any desired temperature between 50° and 150° C. The lower

1956
1921

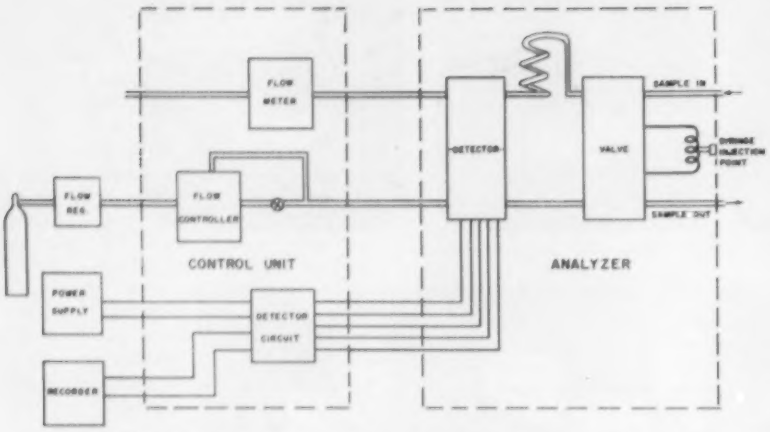
celebrating **35** *years*

of dependable construction

specializing in pipelines.



AMERICA'S FOREMOST PIPELINE CONSTRUCTORS / BARTLESVILLE, OKLAHOMA / CABLE HCPCO



TYPICAL FLOW PATTERN for gas-chromatography apparatus. Fig. 2.

section contains the flow control and valve actuator and is thermostated at 50° C.

The sample and carrier gas lines are separately heated and thermostated at or above column temperature to obviate any possibility of sample condensation within the analyzer. The sample lines are thermally insulated from the walls of the analyzer housing, thus eliminating any cold spots.

Placement of the constant-volume sample valve within the oven offers the unique advantage of metering sample to the column at constant temperature. Since the temperature of the valve and column can be set above the condensation point of the highest-boiling-point component, fractionation can be eliminated.

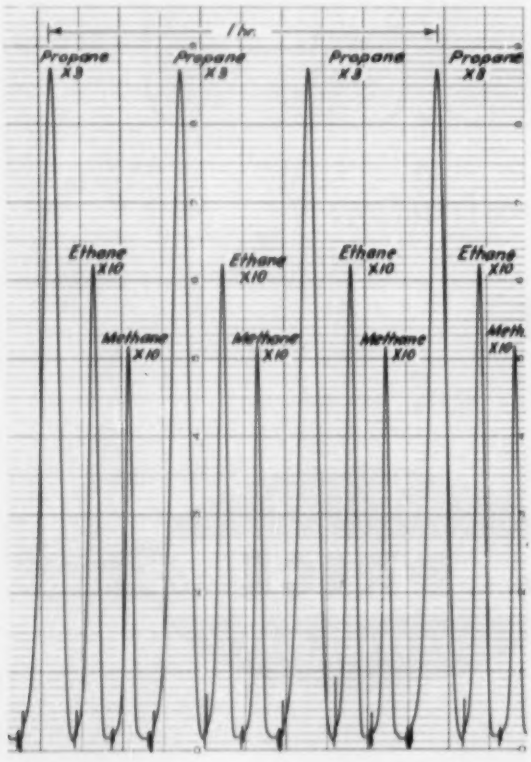
The sample stream constantly purges the sample system up to the valve, hence the only delay time generally experienced is that short time required to purge the small sample volume. The valve is capable of precise injections of sample.

It can operate continuously at the highest oven temperature for at least 1 month without the need of servicing. Should replacement or repair be necessary, the valve is readily accessible and the down time should be less than 15 minutes. A reproduction of a series of runs made on a three-component mix to demonstrate the extreme reproducibility of the valve is shown in Fig. 3.

Detectors . . . The detectors are four heated-wire thermal-conductivity elements arranged in bridge configuration. The elements may be replaced separately in case of failure. A coarse zero control on the control unit eliminates the need for matched detectors. The life of the detectors will depend on the sample type and the sensitivity desired, but a 6-month trouble-free operation should be attainable.

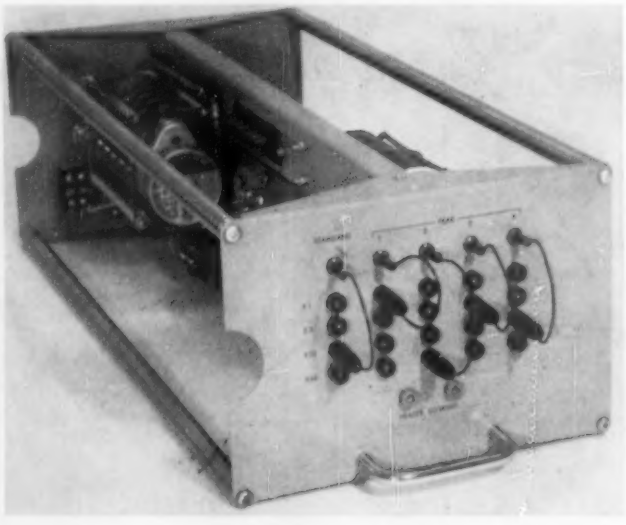
The constantly flowing eluting gas stream in the process instrument tends to carry off the liquid phase coating the solid material of the column. If this process were not made extremely slow (i.e., by the use of a high-boiling liquid phase) the operator would find a constantly diminishing resolution and, even more annoying, a decreasing appearance time of the components at the detector, making accurate programing of the recorder impossible.

Since higher-boiling liquid phases are generally less efficient, provision must be made for longer columns in order to obtain adequate resolution between components. The analyzer has provision in the thermostated oven portion for the relatively short columns required for absorption separation which are packed with such materials as char-



ANALYSIS REPRODUCIBILITY is shown by this reproduction of a series of runs made on a three-component mixture. Fig. 3.

SEVERAL ATTENUATIONS are possible in timer operation by a simple patchboard arrangement. Fig. 4.



Announcing

the Chromanette Series 9495 A Portable Instrument

POCKET EDITION of the Series 9400* *Podbielniak* CHROMACON

BASIC PRINCIPLE OF OPERATION: Based on partition elution (or adsorption elution), Vapor Phase Chromatography. Components are eluted with CO_2 (Janak method), and measured in a nitrometer, following removal of CO_2 in a caustic solution.

INDUSTRIES SERVED

Refineries
Steel plants
Natural gasoline plants
Gas Producing fields
Chemical and Petrochemical plants
Gas utility companies for analysis of natural or manufactured gases.

APPLICATIONS: Applicable to the qualitative and quantitative analysis of almost any gaseous mixture as:

Nitrogen	N-Butane	Hydrogen
Oxygen	Isobutane	Helium
Methane	Butene-1	Carbon Monoxide
Ethane	Isobutylene	Acetylene
Propane	Cis Butene-2	Argon
Ethylene	Trans-Butene-2	Neon
Propylene	Low-boiling Freons and others	Xenon
		Krypton

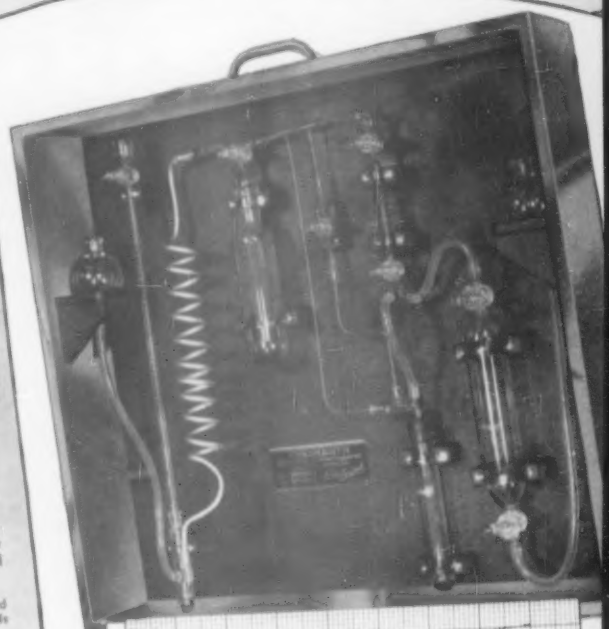
FEATURES: Portable and Inexpensive—No larger than a "one-suiter." Excellent for "on the spot" analyses, as a portable field test instrument for the analysis of natural or processed gases, or as an instrument in the laboratory. **Rapid Analysis** — Analysis completed in 5 to 20 minutes. **Accuracy**—Approximately 1%. **Simple Operation**—No calibration required, gives composition directly. Operation is simple, may be operated by anyone familiar with the Orsat method. A heated nitrometer may be used to extend the range to liquids boiling up to 75° C.

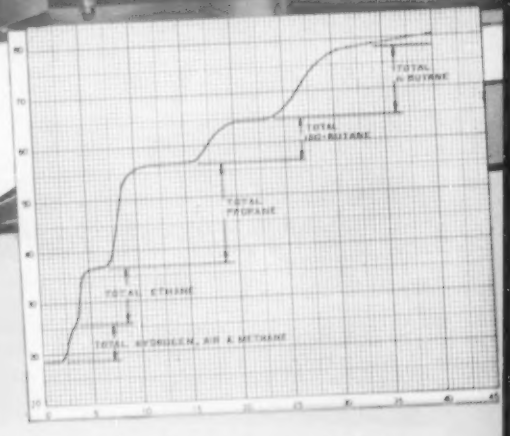
Limitations: Will not determine acid gases as: carbon dioxide, hydrogen sulfide, and any other gas which reacts with caustic solution. Cannot be used for compounds boiling above 40° C. due to condensation within the nitrometer.

Small Samples—1.5 ml. of gas required for complete qualitative and quantitative analysis.

WEIGHT: 15 lbs. **DIMENSIONS:** 24" high; 26" wide; 5½" deep.

PAGE 10,000





Chromanette Graphette Gas Analysis Curve

Copyright 1956 by Podbielniak, Inc.

*Write for CHM-956 & CH-F-856

2:30 A. M.

Dear Log Book: *Graphette #1,635,432*

Little did Botanist Tswett dream that his innocent Sherlock Holmes' device for analyzing leaves would 50 years later start a disturbing competition among scientists for the perfection of a device to "Analyze Almost Anything Accurately."

So consuming is this investigation, that in Podbielniak, Inc. alone, our researchers could not be more stimulated to activity than if we had discovered one of the current rare metals! They forget to go home for dinner... actually come down on Saturdays ... and because we love those with whom we share our activities, we must get severe and threaten ... "Enough for one day! Go home!"

In order to produce an accurate and scientifically, as well as aesthetically designed instrument, it is not sufficient to assemble a panel, a few knobs, and some twiddlers. This is the reason the above laboratory report book is numbered: "10,000th Page." It has taken considerable investment to produce the 14 Deluxe Volumes of Our Chromacon Apparatus, so completely illustrated in Brochure No. CHJ. 856.

This Pocket-book Edition Chromanette Model Series, as indicated in Graphette No. 1,635,432, represents a Slice of the Series 9400 Deluxe Chromacon. Slightly less than 15 lbs. ... no larger than a portmanteau ... this Chromanette Model should be Voted the Best Seller.

The Chromanette Series 9495, will be particularly useful in refineries, steel plants, natural gasoline plants, gas-producing fields, chemical and petrochemical plants and gas utility companies for analysis of natural or manufactured gases for "on the spot" analysis.

The Chromancer Plant, which produces extremely pure products, should also warrant his interest. The Podbielniak Institute Training Course for reviewing all phases of vapor phase chromatography, both from a theoretical as well as from a practical standpoint, will complete the "know-how" required to use these fascinating new devices.

It's very late, and even my two Simian assistants are impatient! Joey is scolding as he wants to close this heavy book, while Jimmy, our little philosopher, patiently waits until we are ready to sign off.

So until the next experiment ...

Excitedly yours,
(Mrs.) Walter J. Podbielniak
Executive Vice President

PODBIELNIAK, INC. 341 East Ohio Street Chicago 11, Illinois

coal, alumina, or for molecular sieves, and has space for up to 50 ft. of ⅜-in. tubing for gas-liquid phase separation.

Control . . . The control unit contains the master timer and the detector power supply. The master timer introduces the sample to be analyzed at constant time intervals which may be chosen between 5 minutes to 1 hour. The timer also attenuates the signal for up to four peaks or groups of peaks with several attenuations available by a simple patchboard arrangement (Fig. 4).

Should the sample contain a component of higher thermal conductivity than the carrier gas, normally giving a negative peak, the timer can be made to automatically reverse the polarity of the bridge output signal just prior to the appearance of the component, thereby keeping all peaks on scale.

Dry cells, storage batteries or semi-regulated a.c. supplies for the bridge detector are in general unsuitable. The control unit contains a tubeless, battery-free transistor power supply.

Adjustments . . . There is always the possibility of slow attrition of the column liquid phase, and the aging of components in the detector bridge and power supply. To correct for the subsequent change in pattern and sensitivity, the control unit has provision for the manual introduction of a standard sample from the control room site, allowing the operator to make gain adjustments while observing the recorder. The operator also has access to a coarse and fine zero adjustment.

It was intended that the control unit be operable in Class II locations, and the cabinet is designed to permit air purging if required. Under favorable conditions the control unit may be operated up to 500 ft. away from the analyzer unit without the necessity of signal telemetering equipment.

Results . . . A reliability run involving repeated introductions of an air sample was made over a 1-month period. The valve was actuated some 17,000 times without failure or apparent damage to the valve surfaces. The oven temperature was maintained at 160° C. throughout this test and the column was 6 ft. of alumina-packed ¼-in. tubing. Carrier flow was approximately 100 cc. per minute.

. . . What of the Future?—7

THE application of vapor-phase chromatography as a field or plant test offers a method which is capable of supplementing the data from, or replacing many existing empirical test methods.

The Janak method of gas analysis is a rapid method of analyzing any gaseous mixture, using a simple portable apparatus. The apparatus used for this method differs from other vapor-phase chromatographic equipment only in the method of detecting components.

The sample is eluted through a partition or adsorption column with pure carbon dioxide. The column effluent enters a nitrometer containing a strong caustic solution which reacts to eliminate the carrier gas, consequently only the components of the sample emerge consecutively to be measured in a calibrated glass burette.

A recently developed portable apparatus for analysis by this method weighs 15 lb., and is completely self-contained including supply of carrier gas. (See lead photograph with this special section.)

The applications of this apparatus, although limited by comparison with laboratory models, are numerous. It is capable of analyzing mixtures of light hydrocarbons from methane to butane accurately, including a determination of the pentanes plus content, inert gases, olefins, and diolefins.

It is applicable to the analysis of liquefied petroleum gases, and in general may be used to determine any non-acidic component of a gaseous mixture. Its use has been reported in several English and French refineries as a portable plant testing method.

The future of this method of analysis will include plant testing, in natural-gasoline plants and refineries, and the testing of natural gases for propane, butane, and pentane-plus content.

Although based on the use of small samples, 1 to 25 ml., the accuracy obtainable with equipment available today makes it appear that this method should be seriously considered as a potential royalty test method which avoids the weaknesses of present charcoal-test procedures.

Its ability to determine propane content accurately, in field gases, is sufficient to justify its investigation by the technical committees of the two natural-gasoline associations.

The use of gas chromatography to continuously monitor the composition of process streams has been reported by several investigators. Recently two new models of equipment were announced for the continuous (cyclic) analysis of process streams.

Although originally limited to gaseous streams, the difficulties inherent in the automatic introduction of minute liquid samples, have been surmounted, and these models are now applicable for the analysis of any gaseous or liquid process stream. Many of the larger petroleum and chemical companies have been quick to utilize gas chromatography in this capacity.

The speed with which results are obtained and the high degree of reliability of the method have stimulated several companies to supplement the automatic vapor-phase chromatographic analyzer with an electronic computer and readout system, capable of controlling the equipment producing the stream being analyzed.

Future . . . In the future we will probably see the use of automatic vapor-phase chromatographic analyzers to continuously monitor various plant streams.

For example, absorber residue gases, L.P.G. products, recycle streams, plant intake gas, and others in a natural-gasoline plant can be analyzed cyclically with a single apparatus.

The operator of the future will find it far easier to adjust oil rate and other operating variables when faced with a continuous record of the composition of the various plant streams.

Larger columns . . . The efficiency of a column decreases but slightly as column diameter is increased. Thus the method is not limited to the use of columns in 1-in. diameter and less. By using 2 to 4-in.-diameter columns, it is possible to process samples to 10 to 25 liquid cc.'s.

Since the time required to complete the elution of a sample is short, this process can be made cyclic and automatic with the result that it is applicable to the purification of a product required in relatively small quantities.

Since the ability to separate an impurity is not limited by a small difference in boiling point, this method offers a unique procedure for small-scale isolation of a component in a very pure state. **End.**

From material by W. J. Podbielniak and S. T. Preston.

NATIONAL'S NEW "COG" SEPARATOR

WHAT THIS SEPARATOR WILL DO FOR YOU:

*COG – Conservation of Oil and Gas. COG is the trademark of National Tank Company. Patent Applied For.

PROBLEM:

Operate low pressure oil-gas separator at normal predetermined pressure, yet have sufficient pressure at any time to push oil through lines into tanks. Required that no gas vent oil carry-over will occur.

SOLUTION:

Install a new National "COG" Separator with dual controls and reap these benefits:

- With near zero psi on separator at time well intermitter opens the flow valve, there is a greater pressure differential across the well head, permitting greater benefit of entrained and dissolved gas in the tubing by at least one atmosphere of expansion. This acts to unload the well more quickly or give the well a longer flow life.
- For gas lift wells, less gas will be required, thus reduce such cost of producing.

The "COG" operating pressure does not start upwardly until the oil reaches the separator and causes the float to rise, automatically adjusting the gas valve to only that pressure necessary to push the oil to tanks.

- Sometimes a pumping well will flow for a time after the fluid head is pumped off. When this happens, a tremendous head of oil will "hit" the separator. If enough back pressure is held on the separator to prevent carry-over at times when the well heads, at all other times the unnecessary higher pressure reduces the tendency to flow, reduces the pump efficiency, and causes faster rate of wear on stuffing boxes, etc.

But, if a "COG" Separator is used, when only 10 psi is needed on the separator, it's there automatically; when 40, 50 or even 100 psi or more is required, it's there too, automatically.

- Many oil wells flow by heads. If the normal operating pressure of an oil-gas separator is 25 psi, and the back pressure is not sensitive to oil level within the separator, then the obvious occurs when the oil head "hits" the separator. As high as two barrels of oil may go out the separator gas vent for big heads of oil.

But not so with a "COG" Separator. A minimum predetermined pressure can be set with the controls. If the fluid rate becomes too high for normal operating pressure, causing a rising fluid level in the "COG" Separator, the "COG" dual controls automatically increase the back pressure to that required to move the oil. Such increased back pressure moves the oil out of the separator at a faster rate and tends to restrict the inlet rate also, but ONLY during the time of excessive flow into the "COG" Separator.

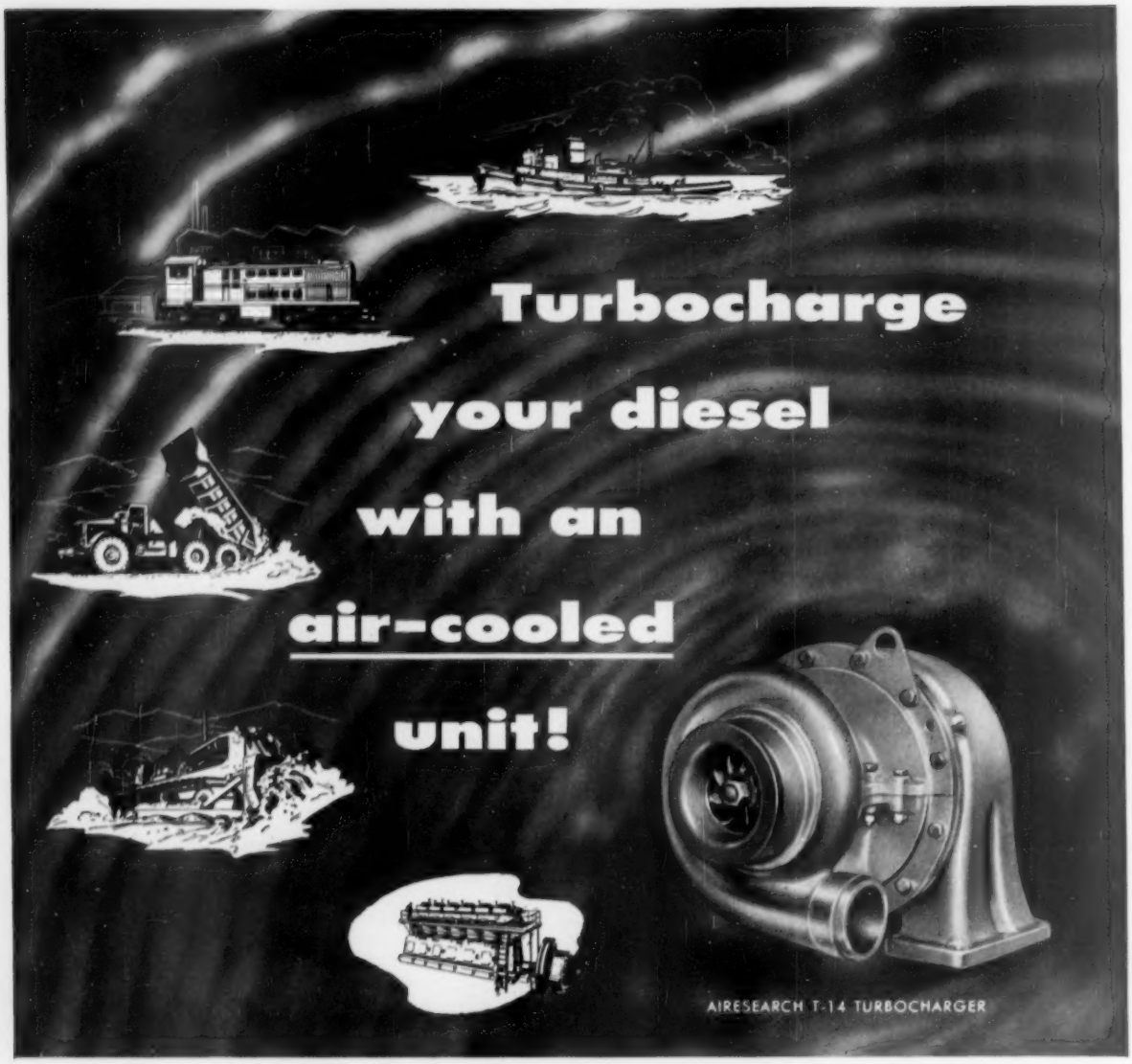
- Sometimes lease storage tanks are connected together and to the separator with larger than necessary pipe and fittings such as 3" in place of 2", so that when heading flows are produced through the separator, downstream restriction that might cause flooding in the separator is minimized.

When using the "COG" Separator, extra large size lines to the tanks are not needed; because if increased pressure drop occurs in the line from separator to tanks (such as may be caused by higher flow rates, increased viscosity due to lower temperatures, partial vapor lock, partial filling of line with water, or other cause) the level will rise in the separator and automatically create higher pressure to compensate for the increased pressure drop.

- All additional savings, increased revenue and operational advantages are yours at no extra cost when the National "COG" Separator is on the job.

"ANOTHER FIRST"

National Tank Company • Tulsa, Oklahoma



AiResearch turbochargers increase power to the full capacity of the engine, yet require no extra plumbing and put no added burden on the cooling system.

The diesel industry generally has recognized the fuel-saving, noise and smoke reducing and power-adding advantages of turbocharging. But there are important differences between turbochargers. Some are difficult to service and add complicated plumbing because of the necessity for water-cooling.

All AiResearch turbochargers, from the smallest units for mobile equipment to the large, stationary power plant models, are air-cooled. Each contains a removable rotating assembly which simplifies maintenance, especially in the field. Their modern design resulted from the most extensive experience in the field of small turbomachinery in America.

We invite your inquiry on their application to your diesel equipment.

BASIC SPECIFICATIONS FOR AIRESEARCH TURBOCHARGERS

MODEL	T-10	T-14	T-15	T-30-2	T-30-6
Diameter — in. nom.	9	11.5	15.25	15.25	16
Length — in.	9	14.12	16.75	17.25	21.75
Weight — lb.	40	95	125	135	195
Output — lb/min. (Standard Conditions)	25-40	35-65	35-65	70-95	115-175

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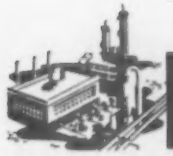

JOB IMPROVEMENT FOR THE PROCESS FOREMAN—73

How to Determine Separation Reflux Ratios

THE effect of reflux on tower-temperature gradient is important from the standpoint of maximum product purity and yield. The quantity of reflux used in a distillation process should be the maximum attainable without tower flooding or heat-supply limiting. Desirable reflux ratios (expressed as barrels of reflux divided by barrels of product) for various light-oil separations are shown here:

Operation—	Desired reflux ratio (Reflux to product)
Depropanizing	4 to 1
Debutanizing	2.5 to 1
Deisopentanizing	10-15 to 1
Gasoline rerun	0.5-1 to 1

When the reflux ratio falls below that shown in the above table, product degradation will result. An example of the (TCC Unit No. 1 stabilizer) is cited below.

On this tower, it is necessary to recover BB for the alkylation unit with minimum pentane content of the overhead and minimum R.v.p. of the bottoms. An increase in pentane content will cut refinery profits by reducing aviation gasoline production.

	Good operation	Poor operation
Reflux ratito	2 to 1	1.1 to 1
Overhead comp. per cent pentanes	2.9	4.1
R.v.p. of bottoms	6.1	6.4

Improper reboiler heat . . . A shortage of reboiler heat will have the same effect on tower-temperature gradient and consequently product quality as low reflux ratio. An example of product degradation which can result from inadequate reboiler heat is seen in the following example.

Data for TCC No. 4 and Houdry No. 3 stabilizers are compared. These towers are designed to produce BB overhead with minimum pentane content and gasoline bottoms with minimum R.v.p.

	Good operation — Houdry No. 3 stabilizer adequate heat supply	Poor operation — T-4 stabilizer short heat supply
Per cent pentane in BB	1.5	10.7
R.v.p. bottoms	5.3	13.5

Improper feed temperature . . . The percentage vaporization of the feed to a tower as determined by feed temperature has an important effect on the separation of products. As a general rule, it is desirable to select a feed temperature such that the percentage vaporization of the feed is equal to the per cent of the feed to be taken overhead in the distillation operation.

For example, in depropanizing, a stock containing 3 per cent propane and lighter, it would be desirable to operate with a feed temperature high enough to cause vaporization of 30 per cent of the charge. Increased vaporization (high feed temperature) of the charge causes overflashing and, consequently, overloading of the upper section of the tower.

This tends to contaminate the overhead product with heavy ends. Too low a feed temperature will result in excessive quantities of relatively cold liquid reducing the temperatures in and overloading the bottom section of the tower. This results in contamination of the bottoms product with light ends.

An example of how too high a feed temperature increases loss of heavy ends is shown in the following data taken from operation of the polyform unit depropanizer.

	Good operation	Poor operation
Feed temp., °F.	235 or less	275
Per cent butanes in overhead*	2.8	4.4
BB production	2,700	2,100

*Lost as alkylation unit charge

Improper feed location . . . The necessity of having bubble trays above the feed (rectifying section) and below the feed (stripping section) has been previously discussed. If the feed stream does not enter the tower on the proper tray, the fractionation job in one section of the tower will be much more difficult than in the other section.

For example, if the feed location is too high in the tower, the rectifying section of the tower will be too short to sufficiently knock the heavy ends back. As a result, the overhead product purity or yield will be reduced.

This difficulty is not often encountered in the refinery and an example is not cited for lack of data.

Improper cooling water rate . . . A low rate of cooling water to the reflux condensers requires a reduction in reflux ratio and results in product degradation. An example is shown in the section dealing with improper reflux rates. It is sometimes impractical to increase cooling water rates, particularly in the summer when there is a shortage of water supply.

Every effort should be made to allocate cooling water most effectively during these emergencies. Summer shortage of cooling water is one of the most critical processing problems with which we are faced.

Improper maintenance . . . If towers and auxiliary equipment are not cleaned properly during downperiods, fractionation can be seriously impaired. Scale deposits within the tower causes flooding or channeling and, consequently, a reduction in temperature gradient. It is often necessary to cut back the reflux ratio on a dirty tower to prevent flooding.

Fouling of the reboiler or overhead condensers also causes a reduction in reflux ratios and temperature gradient. An example of how fouled overhead condensers affect temperature gradient and product purity is shown for the alkylation unit isobutane tower under the temperature-gradient section.

After cleaning of the overhead condensers, the reflux rate increased from 24,800 to 46,400 bbl. per day and product purity was improved.

This material is taken from "Fundamentals of Refining," operating manual of Magnolia Petroleum Co., refining division, Beaumont, Tex.

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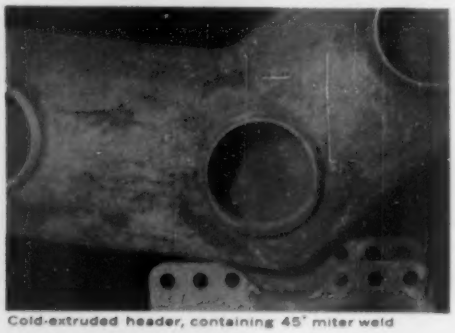
Alloy steel header, with cold-extruded nozzles



Cold-extruded header, containing 45° miter weld

16-in. outlet nozzle, extruded in 30-in. diameter dampener head

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LOWER MATERIAL COST: Elimination of reinforcing pads, saddles and collars makes savings in material costs substantial, especially where alloy steels are used.

SIMPLIFIED DESIGN: Nozzles or branches can be located anywhere along or around the header pipe.

SMOOTH NOZZLE CONTOURS: Minimizing pressure drop, reducing turbulence and erosion.

FASTER PRODUCTION: Less welding, less inspection make possible faster production and quicker delivery.

IMPROVED FIT-UP: Because of uniformly closer dimensional tolerances for each outlet nozzle, fit-up to adjoining piping is simple, accurate.

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Write for Bulletin CE-0.001. EXTRUSION SALES, Fluor Products Company, Paola, Kansas.

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PAINTING STEEL—11

Hot Surfaces Require Special Types of Paint

by J. O. Jackson* and Joseph Bigos†

THE type of paint required for process units in this environment depends upon the maximum temperature to which the units will be subjected and the period of duration of the temperature. Hot surfaces are often not really hot because considerable temperature difference exists between the contents and the outer surface.

Many high-temperature paints are worthless because they will not protect the steel from rusting upon exposure to the weather between periods of heating. Usually alkyd and phenolic paints will be satisfactory up to temperatures of approximately 250° to 300° F. Special alkyds may be obtained for use up to approximately 500° F.

Pigment . . . All organic vehicles decompose at approximately 550° F. except silicones; these may begin to decompose at 550° F. and completely decompose at approximately 750° F. To protect steel above these temperatures, the pigment must fuse or cement to the steel. See Table 11 for surface preparation and paint recommendations.

Insulation . . . Because much refinery equipment requires insulation, a few remarks on that subject may be pertinent. Steel should be painted even though insulated if the surface gets below the dew point. Wet insulation often causes serious corrosion of steel. Hot, dry, insulation, if maintained in that condition, is satisfactory for use on bare steel.

*Pittsburgh-Des Moines Steel Co., Pittsburgh. †Senior Fellow, Mellon Institute of Industrial Research. Paper presented at A.P.I. Refinery Division meeting, Montreal, 1955.

If the temperature of the surface is only slightly above atmosphere, wet insulation may not dry out and corrosion will be greatly accelerated. The exterior of insulation should be waterproofed. S.S.P.C.-Paint 12-55T, cold-applied asphalt mastic, or a similar mastic, may be used for insulation where a thickness of approximately ⅛ in. is satisfactory.

Paint 12 is also highly recommended for sealing the exteriors of porous insulation such as magnesite, glass fiber, and cork.

TABLE 9—PAINT SYSTEM NO. 4 VINYL PAINT SYSTEMS[1]

(For chemical exposure, fresh and salt-water immersion, alternate immersion, high humidity and condensation, and weather exposure.)

Paint System No. 4 is highly resistant to most chemicals and water. The standard system requires commercial blast cleaning or pickling, and wash primer pretreatment of the surface. The standard primer is Military Specification MIL-P-15929A (red lead vinyl paint). This paint will not adhere to bare steel.

Alternate vinyl primers are: MIL-P-15930A (zinc chromate); S.S.P.C.-Paint 8-55T (aluminum for water or atmosphere); and S.S.P.C.-Paint 9-55T (titanium dioxide pigments for maximum chemical resistance).

Vinyl and vinyl alkyd alternate primers in various colors are included. The standard system calls for aluminum vinyl finish paints. Vinyl alkyd finishes brush better but have less chemical resistance. S.S.P.C. vinyl paints may be used over bare steel, wash primer, or other vinyl resin paints.

TABLE 10—PAINTING OF CHEMICAL AREAS[2]

Use Paint System No. 4 vinyl paints for alcohols such as methyl, ethyl, isopropyl: salts such as chlorides, nitrates, sulfates of ammonia, copper, iron, sodium, potassium, calcium: inorganic acids at low temperatures, low concentrations: caustics and alkaline salts at low temperature: aliphatic solvents and gasoline, fuel oil, sour crude oil: water solutions of most salts.

Use Paints 9 and 106 for maximum chemical resistance. Do not use for prolonged direct contact with aromatics or lacquer solvents. Apply sufficient coats to have a minimum of 5 mils dry.

Use P.S. 3 for mild concentrations of corrosive chemicals such as yards, structural steel, etc.

Use Paint 103, black phenolic, for maximum chemical resistance in milder areas: where appearance is important, use Paint 104 for colored phenolics, or proprietary phenolics formulated especially for chemical resistance.

Use P. S. 9 for strong concentrations of corrosive chemicals in yards or structural steel in plants. A rust inhibitive primer compatible with the mastic should be used when cold-applied mastics are specified. Coal-tar enamel and mastic have poor resistance to acids but good aliphatic resistance: the asphalt mastic has good acid but poor solvent resistance.

TABLE 11—HIGH-TEMPERATURE PAINTING[2]

Surface preparation—
Up to 250°-300° F.:
The surface preparation should be adequate for the paint vehicle. Alkyds will often be used and they should be used over clean steel; hot phosphate pretreatment desirable.
250°-300° F. up to 500°-600° F.:
Blast clean or pickle; hot phosphate pretreatment satisfactory.
Above 500°-600° F.:
Blast clean—no pretreatment, no rust, dirt, oil or grease tolerable.
Paint—
Up to 250°-300° F. top:
Use P.S. 2 or P.S. 3; 2 or 3 coats.
Up to 350°-400° F. top:
Use coal-tar paints: two or three coats.
Use TT-E-496, heat resisting: black, two or three coats.
Up to 450°-550° F. top:
Special alkyds, modified silicones, proprietary paints.
Up to 800°-900° F. top:
Aluminum or zinc dust—silicones, zinc dust-silicates, butyl titanate paints and proprietary paints.

REFERENCES

1. Bigos, Joseph, "Preparing Specifications for the Painting of Steel Structures," Consulting Engineer, October 1955.
2. Steel Structures Painting Manual.

by W. L. Nelson
Technical Editor

QUESTIONS ON TECHNOLOGY

Effect of Reduced Capacity on Refinery Operating Costs

In connection with your "Effects of Refinery Capacity on Operating Cost," we wondered if you have similar studies on operation at low capacity or the effect of cycle-time efficiency?—Wm. F. M.

Among the costs of refining, the costs of tetraethyl lead, treating, utilities, fuel, and much of the maintenance (wear and corrosion) are fixed per barrel costs regardless of how much is processed, whereas such costs as investment and labor (and its burdens) become variable per barrel costs which rise at low capacities. Investment and labor costs are the major cost items and accordingly, the cost of refining increases rapidly when operations are reduced below rated capacity. Somewhat the same applies to the effect of cycle-time efficiency except that additional costs of inspection and repair are generated by shutdowns. Thus, reduction of average capacity by shutdowns increases the per barrel cost of refining more than deliberate reduction of the daily capacity.

The percentage of the total refining cost that arises by investment and labor charges is compared in Table

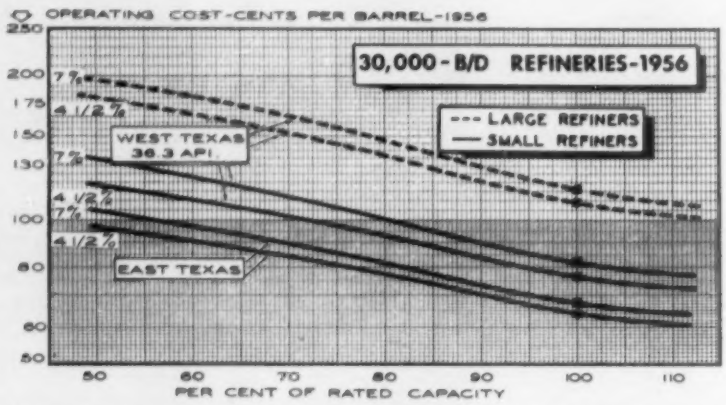

Fig. 2—Effect of operation at reduced capacity (or of cycle-time efficiency) on reduced cost (1956).

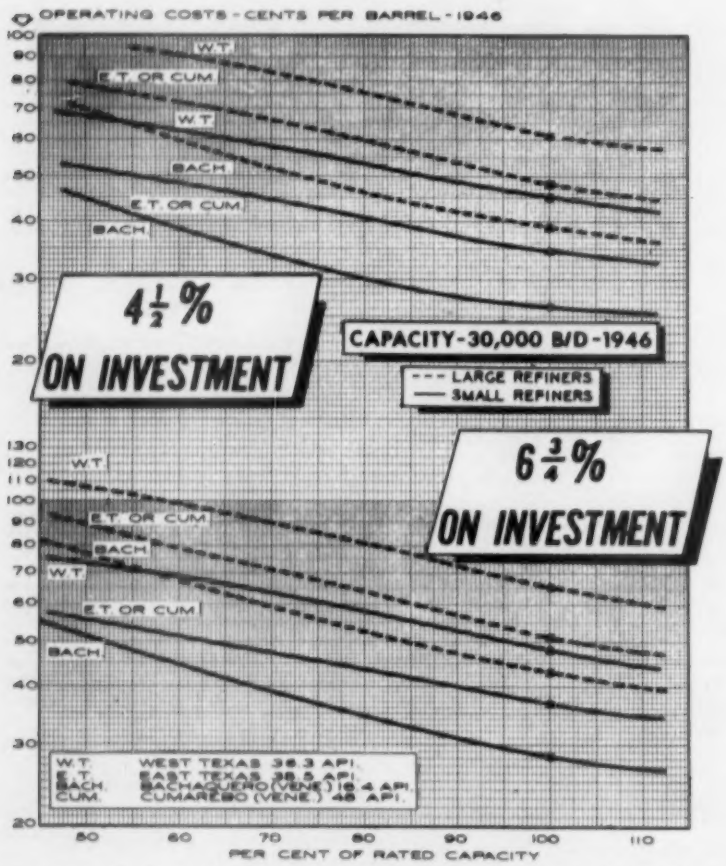

Fig. 1—Effect of operation at reduced capacity on the cost of operation (1946).

1. In some instances it was necessary to make approximations. The larger "other costs" for West Texas and East Texas crude oil arises mainly through the cost of upgrading the gasoline. Bachaquero and West Texas also involve high costs for sulfur and corrosion.

Per barrel cost of refining can be illustrated with the first data in Table 1. If the plant were to operate at 50 per cent of capacity, the labor and investment charges would be double on a per barrel basis whereas the "other costs" remain constant:

	Relative operating costs at these percentages of capacity	
	100	50
Labor and investment	73	146
Other costs	27	27
Relative operating cost	100	173

The results of such a study of four crude oils (Bachaquero, West Texas, East Texas, and Cumarebo) on the effect of reduced capacity,[1] are shown in Figs. 1 and 2. It is obvious that the magnitude of the financial or investment charges is an important consideration and accordingly it was introduced as a separate variable. Financial charges of 7 per cent for small refiner and 6.45 per cent for large refiner were included in the costs computed herein. Similar

TABLE 1—REFINERY OPERATING COSTS ON A PERCENTAGE BASIS

	Labor cost*	Investment charges†	Labor and investment	Other costs‡	Ref.
Average (mainly large refiner plants)	37	36	73	27	1
Topping plants—small	36	18	54	46	2
Crude distillation—25,500 bbl. per day			57	43	1
Topping and cracking—small	28	20	48	52	2
Thermal cracking—small	19	23	42	58	2
Small refiners, 30,000 bbl. per day fuel refinery:					
Bachaquero, 16.4° A.P.I.	30	44	74	26	3
West Texas, 36.3° A.P.I.	18	34	52	48	3
East Texas or Cumarebo, 48° A.P.I.	15	48	63	37	3
Average	21	42	63	37	
Large refiners, 30,000 bbl. per day fuel refinery:					
Bachaquero	27	55	82	18	3
West Texas	18	47	65	35	3
East Texas (38.5° A.P.I.) or Cumarebo	16	34	50	50	3
Average	20.3	45.3	65.7	34.3	

*Operating, supervision, maintenance, laboratory utilities, and burdens. †Interest on total investment, depreciation, maintenance materials, obsolescence, insurance, etc. ‡All others including tetraethyl lead, chemicals, catalyst, fuel, power, water, royalties, steam, etc.

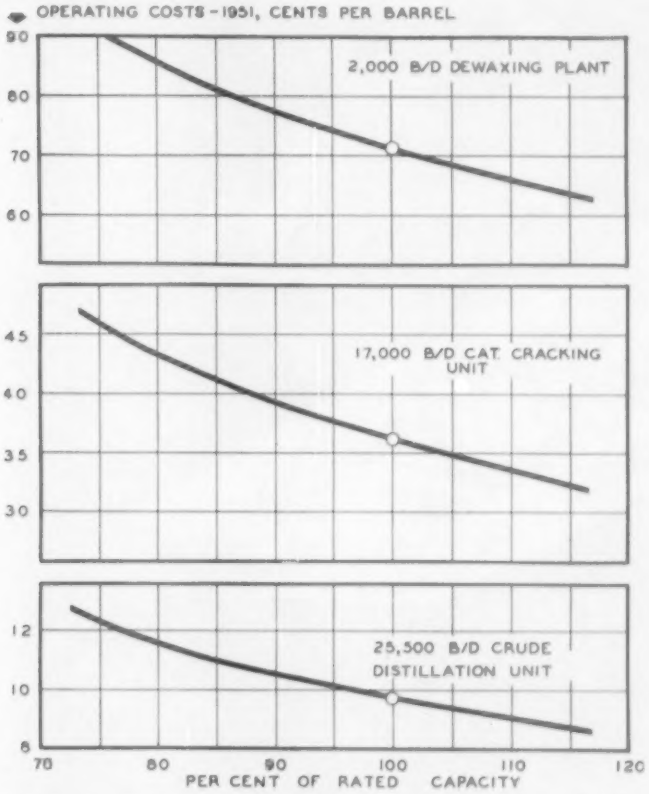

Fig. 3—Operating costs of refinery units when operating above and below rated capacity.

studies of plant units are also reported by McLean and Haigh[1] and their results are shown in Fig. 3.

The refining costs used in developing Figs. 1 and 2 were those derived in the study of the effect of refinery size[3] and they are based on refinery operation at a Gulf Coast location. The very large difference between the costs of small and large refiners has been exaggerated by the selection of a 30,000-bbl. per day plant because such a size is highly efficient when operated by a small refiner and quite inefficient for a large refiner organization. If a comparison between large and small refiners were desired, then sizes of 10,000 and 200,000 bbl. per day (rather than 30,000) should have been studied.

The year 1946 is included because it is somewhat a basic year with respect to construction costs[4] and operating costs.[5]

References

1. McLean and Haigh, The Growth of Integrated Oil Companies, Harvard Graduate School of Business Administration, 1954.
2. Nelson, W. L., Profit Per Barrel of Extra Throughput, The Oil and Gas Journal, May 5, 1945, p. 113.
3. Nelson, W. L., Effect of Refinery Capacity on Operating Cost, The Oil and Gas Journal, (date to come).
4. Nelson, W. L., Refinery Construction Cost Index, The Oil and Gas Journal, July 7, 1952, p. 105, and published in the first issue each month in the Engineering Section.
5. Nelson, W. L., The Oil and Gas Journal, July 13, 1950, p. 98.

Capacity of Side-to-Side Trays

Can the equation on page 437 of Petroleum Refinery Engineering be used for "disk-and-doughnut" plates operating at a vacuum of 150 mm. absolute? S.S.G.

The equation often referred to as the Brown-Souders equation can be used for the capacity of tower trays of the type known as side-to-side pans, etc., except that the capacity is usually higher by about 50 per cent. However, when operating under vacuum and if the last traces of entrainment must be eliminated, the equation as it stands seems to best represent the situation. The answer of April 9, 1956, page 131, entitled, "Capacity of Vacuum Towers" on the Questions on Technology page, applies because the construction of vacuum flash towers or jugs in the petroleum industry is generally similar to side-to-side tray constructions.

This department was created for the purpose of aiding managers, superintendents, engineers, chemists, and all those engaged in various phases of plant operation, as well as those connected with the marketing and utilization of petroleum products. Readers are invited to submit their problems to W. L. Nelson, technical editor. Inquiries must be signed, but only the initials will be printed.

Holiday Greetings
HC Smith
OIL TOOL CO.

Among the Drilling Contractors

Kansas Drilling Firm Adds Oklahoma Division Office

Garvey Drilling Co., headquartering at Great Bend, Kans., reports the recent completion of another phase of its steady expansion program.

NEAL COLBY

This involved establishing an additional division with headquarters at Oklahoma City, where an office, located at 405 Cravens Building, recently was opened. A previous expansion move involved a divisional office in Colorado.

Neal D. Colby, contact representative of the company, now is headquartering at the new Oklahoma City office following his transfer from Great Bend. Claud W. Bard is general manager with headquarters at Great Bend.

The company currently is operating two large rigs in Oklahoma, one in Garfield County and the other in Texas County.

Jett Drilling Co., Inc., Shreveport, in a deal with Justiss-Mears Oil Co., of Jena, La., will drill a 9,200-ft. Tuscaloosa test at a wildcat location 2½ miles northwest of Locust Ridge field, in Tensas Parish, eastern Louisiana. Location is for 1 Loyd, in 28-11n-11e.

ON THE DECK of Delta Offshore Drilling Co.'s recently launched offshore mobile drilling unit are H. A. Broughton (left), drilling superintendent, and A. F. Landers, diesel-electric consultant. The unit with its large diesel-electric drilling rig now is operating under contract for California Co. in the Bay Marchand area, Gulf of Mexico, off the coast of Lafourche Parish, Louisiana.

New Company to Operate Former Dallas Partnership

C. I. Holliman has purchased the interest of the late H. F. Gibson in their contract-drilling partnership of Gibson & Holliman, of Dallas, and has reorganized and incorporated the firm to operate as Holliman Drilling Co.

Officers of the new incorporation include Holliman as president; C. H. Pratt, Jr., vice president; and Leland Breckenridge, secretary-treasurer.

The firm will continue to maintain headquarters at Dallas, in the Fidelity Union Life Building, and its branch office at Ardmore, Okla., in the Little Building, where Carl Holliday, drilling superintendent, is in charge.

It is operating six contract drilling rigs in North Texas and Oklahoma. Two of these currently are working for Weimer & Fitzhugh, in McClain County, Oklahoma, on 10,200-ft. contracts. One rig is drilling for The Texas Co. in Stephens County, same state, on a 5,700-ft. contract. Two rigs have been on workover jobs in North Texas, one for R. P. Karrl, in Grayson County, and the other for C. I. Holliman and associates, in Cooke County. The sixth rig is not reported active.

Montgomery Drilling Co., El Dorado, Ark., has a new wildcat operation southeast of Lewisville, in Lafayette County, southwestern Arkansas. It is a contract job for the account of Don D. Montgomery, of the drilling company, and several associates. Location, at 1 Ford, in 35-16s-24w, is about 4 miles north of McKamie-Patton field. It is set up as a Smackover test with objective about 8,300 ft.

South States Drilling Co. is getting started on a 8,300-ft. Travis Peak test 9 miles northwest of Gilmer, in Upshur County, East Texas. It is a contract job for F. R. Jackson, of Longview, Tex., at 1 Morris, in the S. L. Hill Survey.

K. L. Kellogg & Sons, Los Angeles, will drill a deep exploratory test for Standard Oil Co. of California about

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Trying to break out galled and seized new tool joints often results in bent drill pipe. You can prevent this by making up new joints with 'Bestolife Lead Seal. 'Bestolife provides the necessary film strength and metal cushioning to prevent galling and seizing during the critical break-in period—and permits easy break out. This means long, economical life for tool joints. 'Bestolife is stocked by leading supply houses the world over. In 1¼, 5, 20 and 50 lb. cans. Unconditionally guaranteed.

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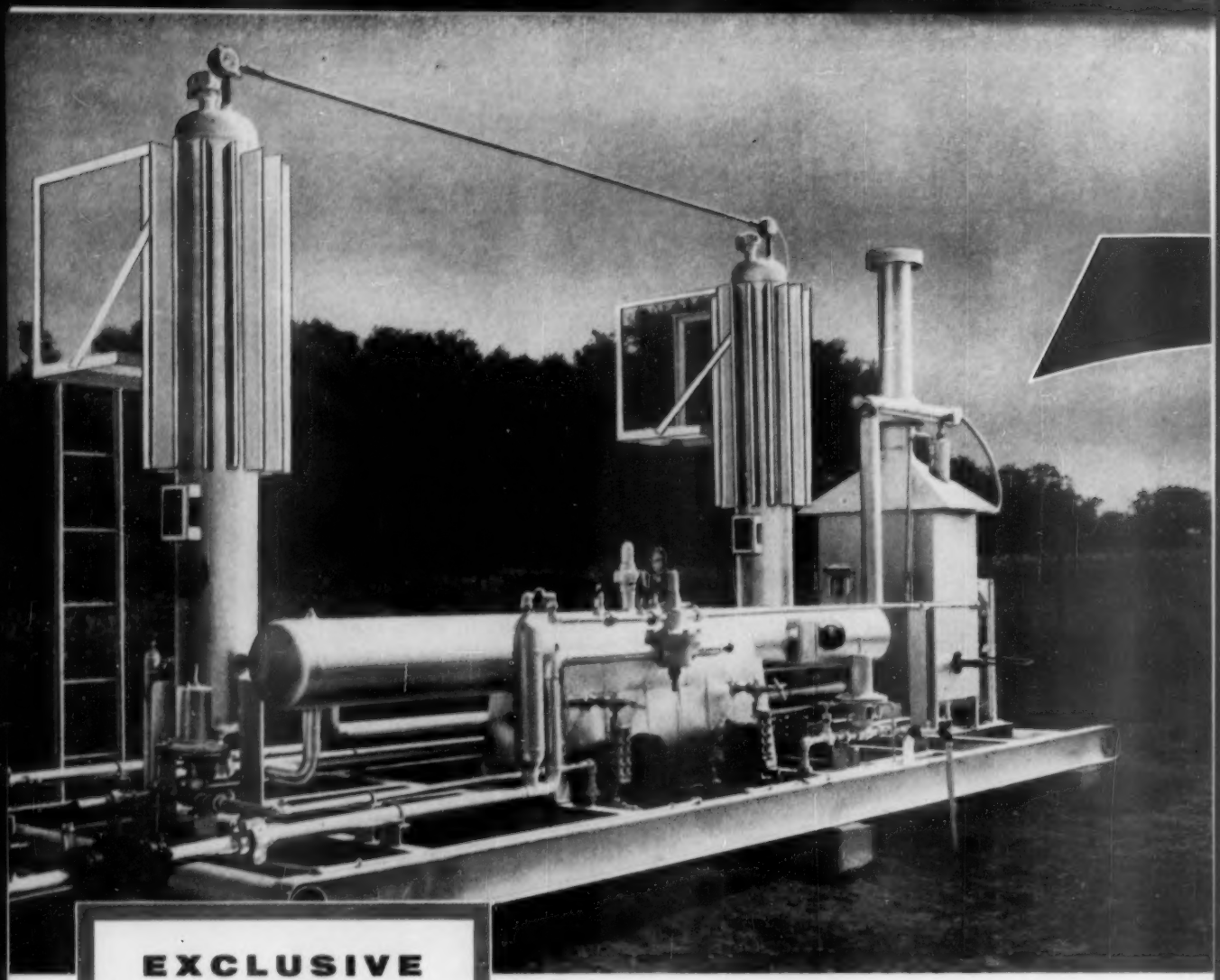
Edward Valves, Inc., Subsidiary of Rockwell Manufacturing Company, East Chicago, Ind.



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More saving results from its lower operating costs. The DAU Weldrier uses less than a third as much desiccant as similar dehydrators of similar capacity —only 20% as much fuel gas. This fuel gas saving can amount to hundreds of dollars per month.

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Now, for the first time, you can dehydrate natural gas at the wellhead. Removal of vapor water at this point eliminates corrosion and hydrate trouble from the gathering system, as well as along the entire pipeline.

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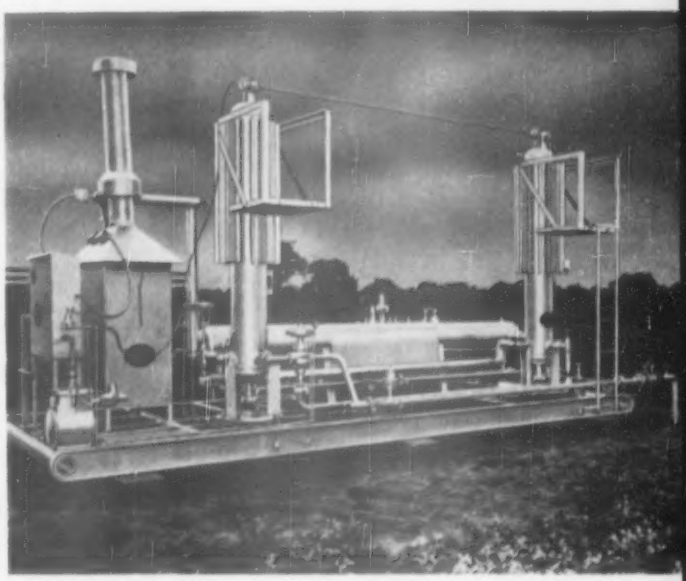
You can afford the advantages and efficiency of individual wellhead Weldriers because they require no auxiliary equipment such as separators, valves, piping and costly hookup time. They are completely unitized and skid mounted—require only four connections to go on stream.

Protect your entire natural gas gathering system, as well as the pipeline, against corrosion and hydrate trouble. Install Parkersburg DAU Weldriers at the wellhead.



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(Advertisement)

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An 80-ft. Harbison-Fischer Double-Displacement® Rod Pump — the longest sub-surface pump ever built — is successfully operating in West Texas and has increased production a whopping 130 Bbl./day. Operator ran the Double-Displacement® Rod Pump rather than pull the production string and install a tubing pump to handle the necessary fluid volume to make the allowable. Although the Double-Displacement® is a regular insert-type pump run on rods, the unit will handle more fluid than a comparable-sized tubing pump.

The Double-Displacement® pump is now making approximately 775 Bbl. of fluid per day on a 26-ft. stroke hydraulic jack. The well is a dual-completion, the Devonian flowing through the casing and the Ellenburger pumping through 2⅛-in. tubing from perforations below 10,000 ft.

The previous pump was a 2⅛"x1¾"x 40' rod pump which only made 90 Bbl. of oil to 290 Bbl. of water on 5 26-ft. S/M. The 2⅛"x2"x2"x80' Double-Displacement® Rod Pump increased the oil production to 220 Bbl. of oil and 555 Bbl. of water on 4½ 26' S/M. Owing to the length of the pump, the assembly was raised in two sections, made up in the well, and then run to bottom as a single unit. The pump was set at 6,000 ft., using a conventional cup-type bottom hold-down.

Other than the unusual length, the pump was of a standard Double-Displacement® design, the same as regularly available through leading supply stores in all major producing areas.

The Double-Displacement® pump is an insert-type, traveling barrel, bottom hold-down assembly made up of two plungers and two barrel tubes which work simultaneously with a single set of valves. In operation, the assembly produces as two separate pumps made up in tandem which virtually doubles the volume of the unit as compared to the displacement of comparable-sized conventional pumps.

The producing situation of the West Texas well was one of two identical conditions for which the Double-Displacement® pump is recommended by the manufacturer: To move more gross fluid, or the same fluid volume at slower pumping rates. In either case, the Double-Displacement® Rod Pump will produce the desired amount of fluid without the operator's having to install a larger bore pump.

The only successful tandem rod pump ever designed, the Double-Displacement® pump was patented by Harbison-Fischer and has been on the market several years. Hundreds are in daily operation in fields throughout the Mid-Continent and Gulf Coast areas.

The pump is available in a wide range of metal-to-metal, H-F "Flexite"®, or soft packing plungers with chrome-plated or heat-treated barrel tubes in 2"x1½", 2⅛"x2", 3"x2½", and 4"x3¼" sizes. Illustrated literature and comparison data are available without obligation from Harbison-Fischer Mfg. Co., P. O. Box 127, Fort Worth, Texas, or from any of the firm's factory representatives throughout the oil patch.

2 miles north of production in Northwest Belgian Anticline field, near McKittrick, in southwestern Kern County, California. Location is on Standard's Western Petroleum Co. lease in 32-29-21. It is southwest of Cymric field and east of Temblor field.

Richardson & Stewart Drilling Co., San Antonio, has contracted for a 13,000-ft. test Arkansas Fuel Oil Corp. will put down in the Cresent Farms-Hollywood area, at Houma, in Terrebonne Parish, southeastern Louisiana. Location, at 1-H Southdown, in 71-17s-16e, is in the narrow gap between the two deep fields.

Warren-Burdette, Inc., Houston, has a rig on a wildcat location 1¾ miles west of Gillis, in Calcasieu Parish, southwestern Louisiana. It is drilling for Anthony J. Tamborello, also of Houston, who plans an 8,800-ft. test. Location, at 1 Pomeroy, in 12-8s-9w, is 5 miles northwest of the north extension area of Gillis field.

Rhodes & Hicks Drilling Co., Alice, Tex., is getting under way on a new contract job 2 miles southwest of Clara in northeastern Duval County, Southwest Texas. It is a 4,500-ft. test for Coastal Trend Oil & Gas Corp. and others at 1 Farmers Life, in E. N. Gray Survey 1. Location is 5 miles northwest of Johns field.

H. L. Edwards Drilling Co., Houston, has the contract on another deep wildcat test Frankfort Oil Co. and Royalite Oil Corp., joint operators, have scheduled for the Constance Bayou area, in coastal marsh sector of Cameron Parish, in southwestern Louisiana. It is a 12,500-ft. job with location at 2 State Lease 2443, in 31-16s-3w. Location is about 3 miles southwest of the area's gas production.

Trans-Tex Drilling Co., Shreveport, has a rig working for Humble Oil & Refining Co. at a wildcat location 3 miles northwest of Rockville, in southern Clarke County, southern Alabama. Plans call for a 12,000-ft. test with the Rodessa and Sligo (Lower Cretaceous) zones as objectives. Location is at 1 Champion-Klepac, in 4-5n-2e. It is 12 miles north of South Carlton field, nearest production.

Waggoner-Lansford Drilling Co., Cut Bank, Mont., is drilling on a development agreement with Flank Oil Co., of Billings, Mont., on the latter's 4,000-acre lease block in the Cadmus area, west of Cut Bank field, in Glacier County, northwestern Montana. The first test is at 1 Bugbee, in 6-33n-6w.

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MAGNESIUM for cathodic protection

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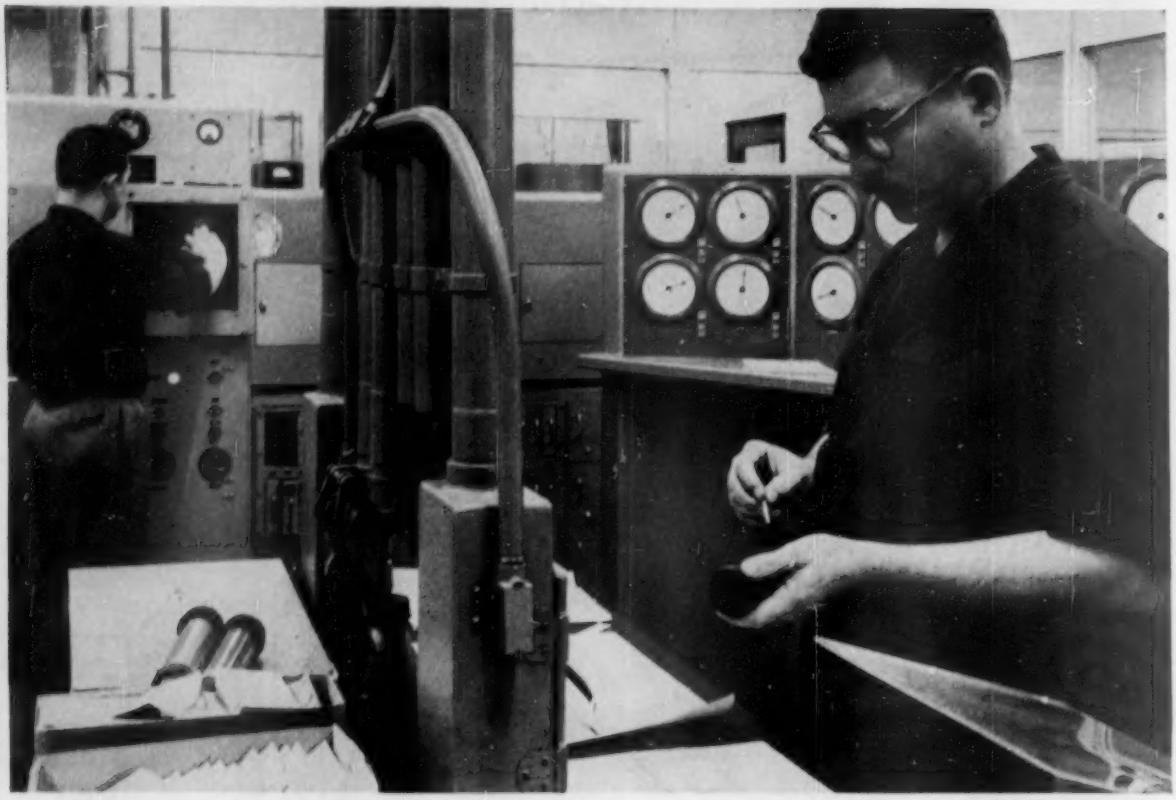

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DOW

For cathodic protection . . .

Zinc anodes provide long-life design

by C. W. Ambler, Jr.

ZINC was the first expendable metal to be used as anode material for cathodic protection. It is still a competitor with magnesium when conditions call for galvanic anodes for protection and a long-life design is desired.

As a current source all galvanic anodes are limited due to physical sizes, soil resistivity, and mutual interference. You can use zinc anodes in soils up to 2,000 ohm-cm. resistivity, magnesium anodes in soils up to 5,000 ohm-cm., and above that rectifiers are needed.

Material and installation cost on a per ampere basis favors rectifiers. You can get currents of an ampere or more from each impressed current anode. Galvanic anodes require about the same labor per installed anode but the current would be about 100 to 200 ma. with limited driving voltage.

Better zinc alloys . . . A.S.T.M. specifications for high-grade slab zinc call for a maximum of 0.005 per cent iron. However, tests have shown that for anodes this figure is too high. Anodes with iron content as low as 0.0004 per cent have proved very satisfactory.

In addition to decreasing iron content, we have found that adding aluminum in small amounts materially increases the anode output. By using as much as 2 per cent aluminum the coulomb output of anodes has been doubled.

These facts were discovered during the war by the Naval Research Laboratories but were not brought to light for commercial exploitation until about 4 years ago. Tests along this line are still being carried on as a joint effort of the American Zinc Institute and International Nickel Co.

Zinc vs. Magnesium

On a weight basis about three times as much current can be theoretically expected from a magnesium anode as from a zinc anode. But the zinc anode will last three times as long. Since magnesium is about three times as active as zinc it is also relatively inefficient from a theoretical standpoint. This inefficiency may be offset to some extent by operating magnesium anodes at high current output with resulting shorter material life.

Some corrosion engineers think that zinc, with a driving voltage of about 0.3 volt to steel, has little use except for galvanizing. However, this relatively low driving voltage and low activity makes zinc ideally suited for an anode installation designed for long life.

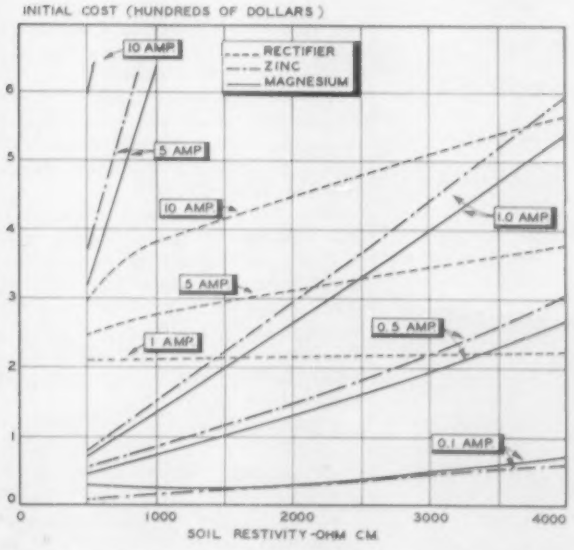
By weight, the material cost of zinc is about two-thirds that of magnesium. When expressed as corrosion efficiency this makes the two materials cost about the same. At the present price this is about 15 amp.-hr. per 1 cent of material cost.

Installation labor . . . Perhaps the significant difference between magnesium and zinc is the installation labor cost. The installation labor for zinc as compared to magnesium on an ampere basis can reasonably be expected to be in the ratio of 3 to 1 in favor of magnesium. By the same token the material life of the zinc-anode installation is expected to be about three times greater than that for magnesium.

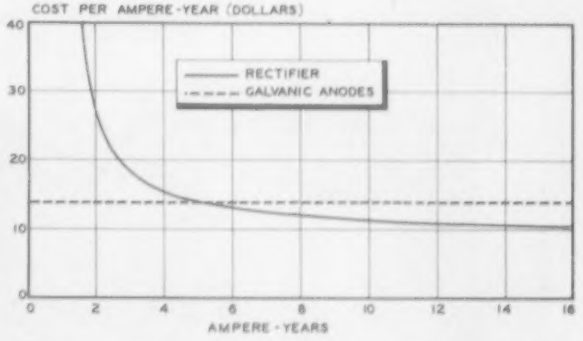
From a total ampere-year output it is rather difficult to differentiate between the cost per ampere between magnesium and zinc provided you are willing to wait for the zinc. Any apparent initial advantage of one over the other may be offset by taxes, interest on investment, depreciation, or other considerations.

One thing to consider on rectifier installations is maintenance. You have all the difficulties that you are plagued with on power lines: lightning, storms,

Author is research metallurgist and corrosion engineer with American Zinc, Lead & Smelting Co.



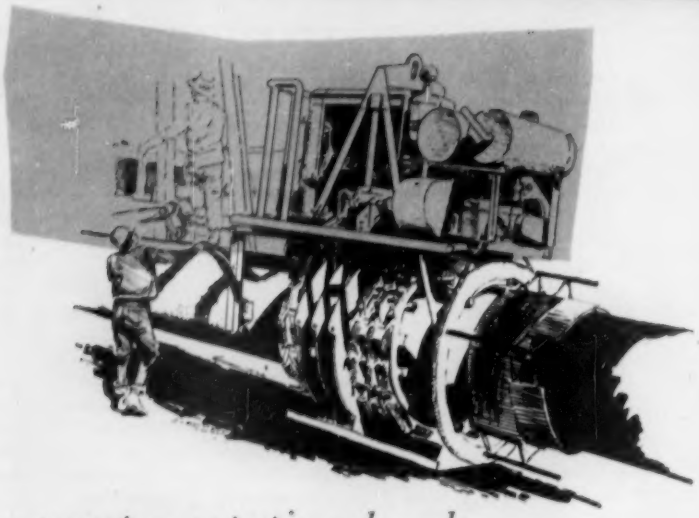
INSTALLATION COST for underground protection system. Fig. 1.



COST of cathodic protection based on protection sources. Fig. 2.

CROSE . . . line traveling

cleaning and priming machines



counter-rotating heads
assure faster cleaning and priming

Counter-rotating heads prevent pipe from turning and give a better cleaning job. Crose machines are ruggedly built yet light weight—specifically designed for faster, trouble-free service on the line. Crose line traveling machines can also be used with a stationary base for yard work. Crose makes machines for cleaning and priming pipe up to 36".

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etc., result in damage to your rectifiers. Rectifiers may require a 30-day inspection while galvanic anodes require no attention other than the periodic check for the effectiveness of the pipe protection.

Installation cost . . . Fig. 1 gives a picture of the cost of installing an underground protection system.

When you require less than an ampere of current, anodes probably will be cheaper than a rectifier. At 1 amp. of current in 1,500-ohm soil the cost of anodes or a rectifier will be about the same—$210. In 1,000-ohm soil the rectifier cost would remain at $210 but anodes could be installed for about $150. One large company makes the break point for 1,000-ohm soil at 5 amp., that is, below 5 amp. they use anodes, above 5 amp. they use rectifiers.

As to the ultimate average cost, anodes are cheaper up to about 6 amp.-yr. (Fig. 2). After that the average cost with a rectifier is cheaper. Anode costs will average about $15 per ampere-year for the life of the anode, whereas over a 16-year period a rectifier installation will average about $10 per ampere-year.

Reference

Woody, C. L., Selection of Galvanic Anodes or Rectifiers for Cathodic Protection for City Distribution Systems.

Pipeline shipments show increase for third quarter

MORE than 1,099,000,000 bbl. of oil was moved in the third quarter by 68 pipeline companies reporting to the Interstate Commerce Commission. That tops the same period last year by nearly 20,000,000 bbl.

The 68 companies reported 1,099,023,000 bbl. from which they derived a revenue of $169,540,000. In the 1955 period they moved 979,069,000 bbl. and received $153,667,000.

More than 40 per cent of the traffic was handled by seven systems. Gulf Refining Co. topped the list with 86,501,000 bbl. for which it got $9,954,000, against 74,573,000 bbl. and $8,984,000 last year. Humble Pipe Line Co. followed with 70,649,000 bbl. and $9,516,000 revenue, against 62,362,000 bbl. and $9,106,000.

Texas Pipe Line Co. was third with 65,346,000 bbl. and $9,413,000 against 61,583,000 bbl. and $9,044,000. Buckeye Pipe Line Co. handled 59,582,000 bbl. for revenue of $4,796,000 compared with 51,808,000 and $4,081,000 a year ago.

How bonding cables prevent arcing

. . . A safe way to prevent explosions

by R. I. Stark

STOPPING corrosion on underground pipelines by applying cathodic protection is becoming more and more common in the oil and gas industry. Over 15,000 amp. of current is drained by cathodic-protection rectifiers from pipelines in the San Joaquin Valley.

If we have a pipeline underground and we have current flowing from the pipeline to the soil, and through the soil back onto the pipeline, we have corrosion occurring at the pipe surface where the current leaves the pipe and flows through the soil. The complete circuit is made when the current comes back on the surface of the pipe and flows along the wall of the pipe back to the area where it originally left the pipe wall.

Author is transmission engineer with Pacific Gas & Electric Co. Paper presented at San Joaquin Valley Oil Industry Safety Conference, October 9-10.

Now, in order to stop corrosion on underground pipelines, it is necessary to make a cable connection to the pipeline, run the cable to a cathodic-protection rectifier, and then out to an anode bed. The electric current, a direct current, flows from the rectifier down the cable to the anode. Then it flows through the soil and out to the pipeline.

In the case of a wrapped pipeline the current will flow onto the wall of the pipe wherever there is a break in the coating. And if you have current flowing onto the pipe surface at all locations along the pipeline, you can't have any current flowing off, thus you have stopped corrosion.

However, if when working on the pipeline, the pipe wall is broken, you are interrupting the circuit and as a result of breaking that circuit you will draw an arc. The only positive way to prevent arcing when the pipe wall is broken is to provide an alternate path around the break in the wall. This is usually done with a bonding cable.

Bonding technique . . . Pacific Gas & Electric Co.'s replacement of 40 ft. of 20-in. pipe in the San Jose area is typical of a high-pressure-gas pipeline-replacement job and the bonding technique that is used.

This particular pipeline was running parallel to and in the same fee strip as a 110,000-volt transmission line. The bonding cable was attached to the pipeline using ears that were welded onto the line and we used regular arc-welding cable.

These ears are just sheet-steel plate drilled to accommodate a bolt which is attached to the welding cable. The ears are welded onto the pipe and then after the job is completed they are knocked off. On smaller diameter pipes, C-clamps are used. The cable can either

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be laid in the bottom of the trench or on the bank of the trench.

Controlled fire . . . The main-line block valves on either side of this location were closed and the gas in the pipeline was blown to atmosphere at a blowoff valve located at one of the main-line valves. Now, since there is always some leakage past these main-line valves, it is necessary to control the pressure of the gas in the pipeline by opening and closing the blowoff valves. The operation of the blowoff valves is directed by the foreman, using a radio from the job site.

When working on a gas pipeline, it is necessary to keep positive pressure inside of the line so that gas will burn on the outside of the pipeline. If this is not done air will enter the pipeline and an explosive mixture will exist inside of the line. All of our welding and cutting is therefore done by a method known as controlled fire.

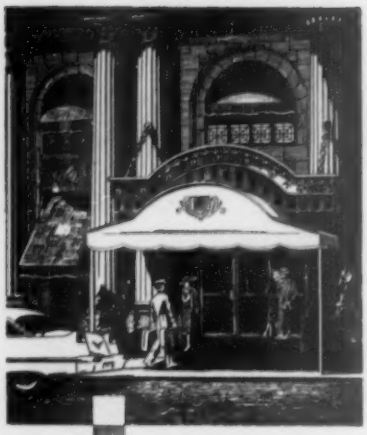
To control the amount of fire and also where the fire is burning, wet asbestos is rubbed into the slot made by the cutting torch. After the cutting operation is completed, the pipe is doused with water, and then it is wrapped with wet canvas to act as an air sealer.

The new section is attached to the existing pipeline using welding bands. These welding bands are held in place during the welding operation by a jack and chain. The gas escaping around the welding bands is ignited by swinging an acetylene torch into the trench and the welding operation begins with controlled fire. The welders wear asbestos suits.

Arc precautions . . . The arc drawn when the pipe section was removed was small because the job was at the midpoint between two cathodic-protection rectifiers.

Pipe replacement was made approximately 7 miles from one rectifier and approximately 10 miles from another. The midpoint between the two rectifiers was only 2 miles from the pipe-replacement job. When the pipe section was cut, the only current that was flowing in the pipeline was the current that was picked up in this 2-mile section of well-wrapped pipe. It actually measured only about 50 ma.

On your next replacement job you may not be fortunate enough to be working at the midpoint between cathodic-protection rectifiers. However, if you make it a rule always to provide a bond cable around your replacement job, you will never have to worry about fires and explosions from arcing.



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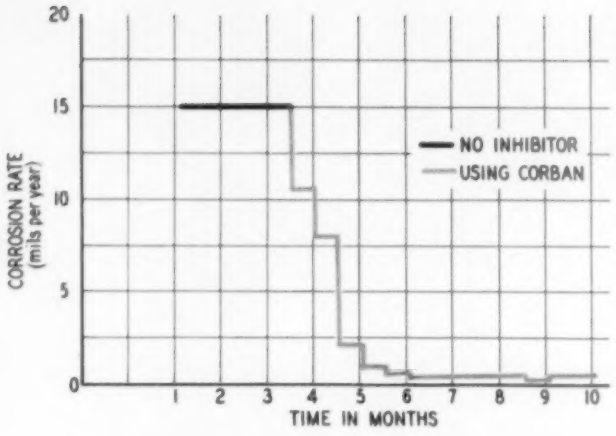
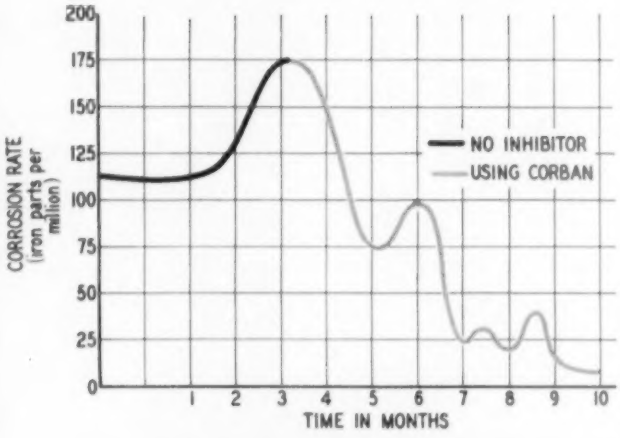
Field experience has proved that Corban extends the life of tubing, casing, fittings, and valves. It also saves time and production by helping avoid workovers necessitated by corrosion-damaged equipment.

Corban, a polar-type inhibitor, is carried throughout the well by the oil or brine, coating all metal surfaces. This durable coating shields the casing, tubing, valves, fittings, and pumping equipment against corrosive agents. Corban is easy to use – does not aggravate emulsion problems. It is available as a "ready-to-use" liquid, a concentrated liquid, or in stick form; also in several formulas to meet any specific well requirements.

Let us recommend a program of well treatment designed especially for your wells. Call any of the 165 Dowell offices in the United States and Canada. In Venezuela, contact United Oilwell Service. Or write Dowell Incorporated, Tulsa 1, Oklahoma.



1 STANDARD TEST uses metal strips inserted in wellhead or tubing. Surface penetration or weight loss indicates degree of corrosion.



2 FLUID ANALYSIS is quick test of corrosion in gas condensate wells. Chart shows parts per million of dissolved iron in water sample.

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Showcase

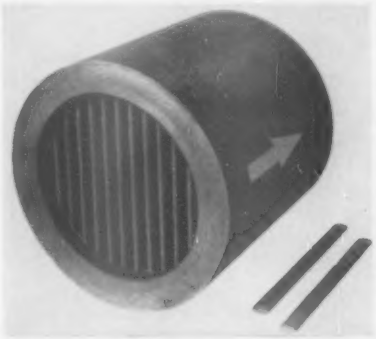
OF NEW EQUIPMENT AND PRODUCTS

by Dan B. Miller

Pipeline Separator Operates At Plus 340 to Minus 40° F.

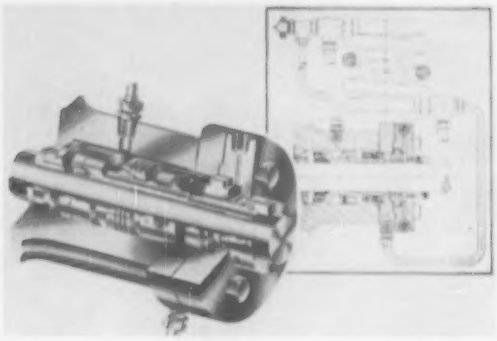
A corrosion-resistant entrainment separator removes liquid particles from air and other gases. The MV scrubber is a compact, self-contained unit ready for inserting in a pipeline. It is an impingement-type entrainment separator made of Karbate impervious graphite. Rods of this impervious graphite, streamlined in cross-section, are staggered in rows within the cylinder. Although minimum clearance is ¼ in., which prevents clogging, a beam of light will not pass through. As the gas to be scrubbed flows through the cylinder, moisture particles impinge on the separator rods and the gas flows on through.

At a pressure of one atmosphere, the scrubber is designed for gas-approach



velocity of approximately 30 ft. per second, at which the pressure drop is less than 1 in. of water. At velocities twice those designed for, reentrainment occurs, but is retarded by the tear-drop cross-section of the separator rods.

The unit can be operated at temperatures ranging from plus 340° F. to minus 40° F., and at pressures from full vacuum to 65 psig. The internal separator rods are keyed in place without cement, thus permitting complete disassembly in minutes for cleaning. **Write or call: National Carbon Co., 30 East Forty-second Street, New York 17, N. Y., for more information on the Karbate scrubber, Type MV.**



New Mechanical Seal Cuts Down Time

A new boiler-feed-pump mechanical seal provides longer service life than that of other sealing methods, thus cutting replacement costs and down time. Maintenance expenses are also reduced. Once installed, the seal needs little further attention and replacement of expensive sleeves is eliminated. Loss of valuable feed water is prevented, since there is no leakage. Long seal life is obtained through the use of a special closed circulating system. This

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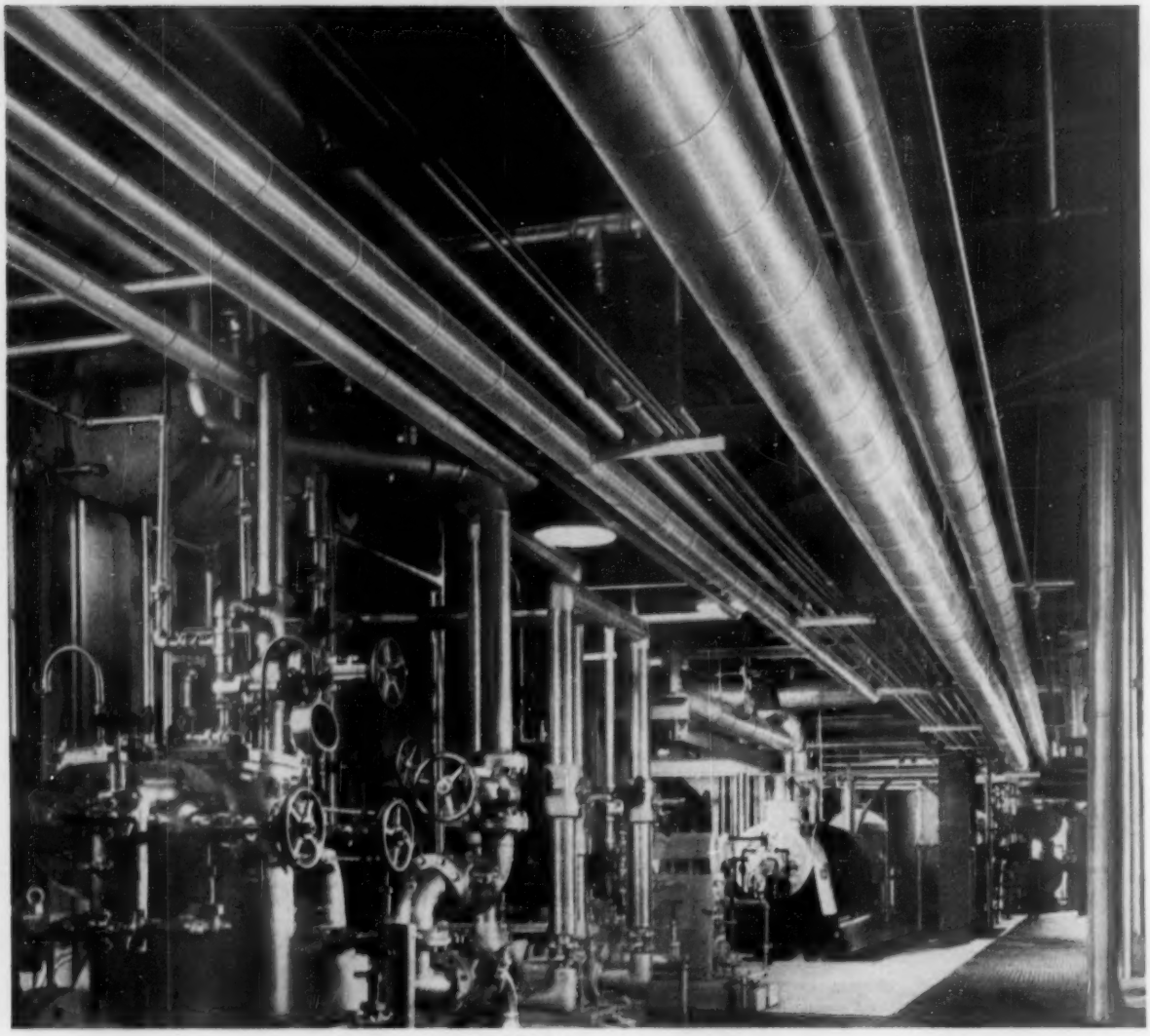

Now, with *snap jackets* made with Kaiser Aluminum, one man can install aluminum pipe jacketing quickly and economically.

An outstanding example of recent improvements in aluminum jacketing techniques, the *snap jacket* is a sheet of Kaiser Aluminum, roll-formed into a tubular shape and stiffened along one edge by an angular crimp. Rigid, but sufficiently flexible, the jacket can be quickly snapped into place around insulated pipe by only *one man* and assures a more durable, more weather-tight installation.

Because it is made with Kaiser Aluminum, the *snap jacket* gives you improved appearance and longer life at low cost.

For immediate assistance on any jacketing requirements, call the Kaiser Aluminum sales office listed in your phone directory. Process Industries Department, Kaiser Aluminum & Chemical Sales, Inc., *General Sales Office,* Palmolive Bldg., Chicago 11, Illinois; *Executive Office,* Kaiser Bldg., Oakland 12, California.

INSTALL ALUMINUM JACKETING

1. ONE MAN can quickly position tubular *snap jacket* for installation.

2. NEXT, same man easily snaps *snap jacket* around pipe, places laps properly and bands the jacket to complete the job.

3. TO SAVE even more time, two men can work together . . . one man snaps jackets in place, follow-up man bands them.

For this new, faster way to install aluminum jacketing, Kaiser Aluminum alloy 5005-H16 is recommended. Other alloys may be used depending on the job, but it is desirable to use one alloy throughout.

Recommended thicknesses of sheet aluminum:

For insulation O.D. of 12.75" and under	**0.020"**
For insulation O.D. of 14" and larger	**0.024"**

Kaiser Aluminum

materials for the process industries

For *complete* information about aluminum jacketing with illustrated on-the-job techniques, send for the new 40-page *free* manual "Kaiser Aluminum Insulation Jacketing Materials And Methods."

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KAISER ALUMINUM & CHEMICAL SALES, INC.,
Process Industries Department, Room 71210
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Please send my copy of your new manual "Kaiser Aluminum Insulation Jacketing Materials And Methods." I understand there is no obligation.

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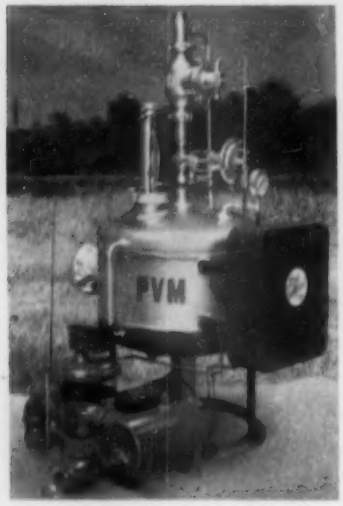
system provides cool water in the sealing chamber.

The new seal comes designed for a particular operation, including adaptation to pump design and piping arrangement. Plans are furnished. All necessary recommendations are supplied and heat-exchanger size is specified. This provides a complete package that can be easily installed without major stuffing-box alteration. **Write or call: Crane Packing Co., Morton Grove, Ill., for more information on the boiler-feed-pump mechanical seal.**

●

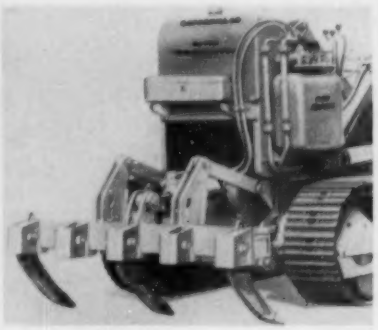


New Meter Measures Positive Volume of Liquids

A new positive-volume meter measures the flow of liquid from well, separator, treater, or tank. Known as the PVM, the meter measures the positive volume between closed valves and is not dependent on accurate repetition of level controls, weirs, or rate of flow.

It is first liquid packed. It then samples and counts as the liquid is discharged. An optional feature is the automatic sampling of each cycle which takes out a pencil-thin core and saves it in a separate container so that the exact content of b.s. and w. can be determined later. The PVM may also be calibrated for an exact volume with compensation made for a given oil composition, temperature, and pressure. **Write or call: National Tank Co., P. O. Box 1710, Tulsa, Okla., for more information on the PVM positive-volume meter.**

●



New Ripper Maintains Same Angle at Any Depth

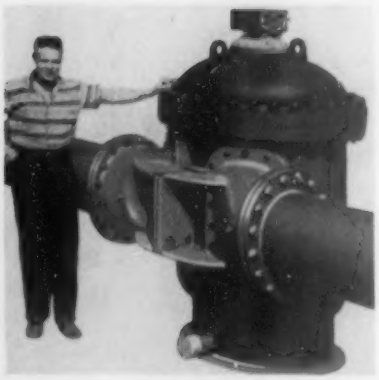
A new tractor-mounted ripper designed to speed bulldozing and loading operations has been added to the Caterpillar line. Designated as the No. 6 ripper, it is designed for use on the Caterpillar D6 tractor and the Caterpillar No. 977 Traxcavator.

Three alloy-steel teeth with replaceable tips are normally installed, but provision has been made for the installation of two additional teeth, if needed. The new ripper is rugged enough to permit the full power of the tractor to be absorbed by one tooth at maximum penetration.

A parallel linkage is used to maintain the same angle of penetration at all depths. The use of this type of linkage permits good ripping action at any depth of tooth penetration in addition to protecting the hydraulic system by reducing cylinder pressures created while ripping.

When the ripper is fully raised, sufficient clearance is obtained to permit climbing a 30° ramp without striking the ground with the teeth. Additional clearance can be obtained by installing the teeth upside down.

A simple method of ripping directly to the edge of a vertical wall or bank is provided by installing the ripper teeth backward and ripping while backing up. Points of the new rippers are interchangeable with those used on the Traxcavator buckets. **Write or call: Caterpillar Tractor Co., Peoria, Ill., for more information on the No. 6 ripper.**



Big Meter Has Capacity Of 10,000 Bbl. Per Hour

The largest rotary positive displacement petroleum meter known has a capacity of 10,000 bbl. per hour. The Model B-700 meter is designed to speed tanker loading, line-flow rate, and other large-capacity streams requiring precise measurement.

The meter is temperature compensated and is equipped with gravity selection. It utilizes a 16-in. dual case. The B-700 currently is being tested at an oil-field pipeline terminal. **Write or call: A. O. Smith Corp. Box 584, Milwaukee 1, Wis., for more information on the B-700 meter.**

●

Dust-Shielding Hood Safeguards Operators

This dust hood protects tractor drivers, dope-machine operators, ditcher crews, and other personnel while building pipelines. The unit consists of a 1½-hp. gasoline engine, two screen filters, an air tube, and an open-windowed helmet. Clean air above the dust line of right-of-ways is pulled into a tall stack, sent through the filters, the air tube, and finally forced out the window of the helmet in a jet of clean air. Dust is prevented from entering the helmet and thus cannot get to the operator's eyes, nose, or mouth.

The dust hood is lightweight and may be attached to any machine.

Vision of the operator is not hindered. **Write or call: Crutcher-Rolfs-Cummings, Inc., P. O. Box 2073, Houston 1, Tex., for more information on the dust hood.**

•

New Hand Lamp Is Portable And Explosionproof

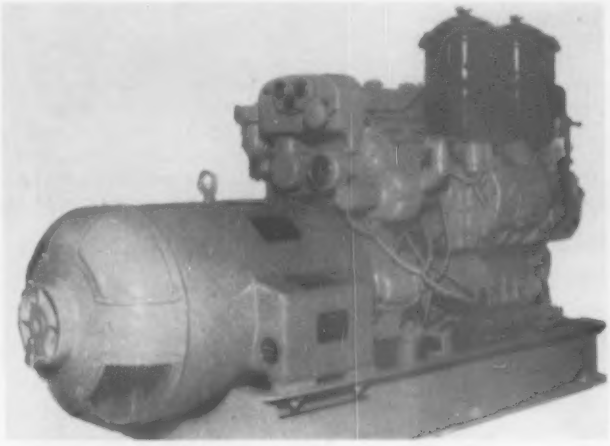
This explosionproof portable hand lamp offers safe yet practical lighting in flammable atmospheres, such as in the interiors of fuel tanks during cleaning or painting operations. Weighing less than 11 lb., the new fixture (Type EVH70) uses 150-watt reflector (PAR-38) spot and flood lamps, which produce a concentrated-light pattern. The fixture is U.L.-approved for Class I, Group C locations (atmospheres laden with flammable mixtures of ethyl-ether vapors, ethylene, or cyclopropane) or Group D locations (atmospheres containing hazardous quantities of gasoline, hexane, naphtha, benzene, butane, propane, alcohol, acetone, benzol, lacquer-solvent vapors, or natural gas).

The fixture's cone-shaped aluminum body is ridged with heat-dissipating fins. Its plastic-coated fiber handle, located at the balance point for easy

carrying, remains cool to the touch after the lamp has been in use for long periods.

The terminal housing, equipped with a cord clamp with a tapered, watertight rubber bushing, encloses three pressure-connector terminals. For working areas with a lot of moisture, a special version of the EVH fixture is available equipped with O-ring gaskets at the relamping joint and terminal housing. **Write or call: Crouse-Hinds Co., Wolf & Seventh North Streets, Syracuse, N. Y., for more information on EVH70 explosionproof hand lamp.**

OIL AND GAS JOURNAL *Showcase* .....OF NEW EQUIPMENT



Generator Supplies No-Spark Power

The Safe-T generator supplies nearly explosionproof power in hazardous locations. The increased safety of this generator is brought about by eliminating all spark-producing parts, commutators, slip rings, and brushes.

The usual way to prevent explosion caused by power generators for drilling rigs has been to relocate the generator exciter and slip rings outside the machine proper and place them in explosionproof housings.

In the Safe-T generator the conventional d.c. exciter with its commutator is replaced with an a.c. exciter. The output of the rotating a.c. armature is rectified by silicon rectifiers mounted on the rotating assembly; the resulting direct current is supplied to the rotating field of the alternator. Since the ex-

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to the **Manufacturer** of the item in which you are interested. See name, address, and equipment name and/or model, in boldface type at end of description.

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Described in OIL AND GAS JOURNAL - Issue of Dec. 17, 1956

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citer armature, rectifier and rotating field form a single rotating unit, interconnected by solid conductors, all arcing contacts are eliminated.

The Safe-T generator is built to American Bureau of Shipping Standards, 100 kw., 125 kw., continuous duty, 1,800 r.p.m., three-phase, 60-cycle, 208/416-240/480 volts driven by a GM series 71, six-cylinder diesel engine. These generators are also available in 1,200 r.p.m. speed and in both 100 and 150 kw. capacities. **Write or call: George Engine Co., Inc., P. O. Box 341, Harvey, La., for more information on Safe-T generator.**

Marker Vent Includes Built-In Junction Box

A new marker vent includes a built-in junction box for cathodic protection test leads. The junction box is cast in one piece with a marker vent and eliminates the need for all other signs, posts, return bends, and junction boxes at road crossings.

The marker vent is cast of heavy malleable aluminum alloy with the sign panel custom designed and painted to match company colors. It is easy to install, corrosion resistant, and cannot be shattered by rifle fire, rocks, or other tools of vandalism. **For more information write or call: Tod Pazdral Pipe Line Specialists, 2525 South Boulevard, Houston, Tex.**

OIL AND GAS JOURNAL *Showcase* OF NEW EQUIPMENT

●

Brakemotors Easy to Adjust, Hold Load If Power Fails

A new line of cast-iron brakemotors stops instantly and holds heavy loads. Features include a wide torque range from 3 to 345 lb.-ft., one-piece molded friction linings for quick stops, and one-operation torque setting. In the event of power failure or low voltage, dead-man operation sets and holds the load until normal operation is restored. The design incorporates a minimum of wearing parts, and any adjustments may be performed with ordinary tools by removing the brake housing and lifting out the entire operating mechanism.

All types of enclosures are available including those suitable for outdoor installation or where extremely moist, corrosive, or abrasive dust conditions exist. Standard enclosures include protected, totally enclosed nonventilated, totally enclosed fan-cooled, and explosionproof Class I, Group D and Class I, Groups E, F, and G. **Write or call: Reliance Electric & Engineering Co., 1088 Ivanhoe Road, Cleveland 10, Ohio, for more information on the brakemotor line.**

H&M MODEL "30"

You're "paying for the butcher's thumb" when you use *oversized equipment* on 30" pipe cutting and beveling operations! — because H&M Model "30" is designed *specifically* for the 26" to 30" range of pipe — *at lower cost.*

The increasingly widespread use of 30" pipe on gas transmission lines demands specialized equipment for greater savings, more speed and efficiency.

So, H&M now offers its Model "30", built on the same split-gear principle as all H&M machines, and with the same lightweight but rugged construction, with same ease of operation and economy in both field and shop.

WRITE FOR ILLUSTRATED BULLETINS ON THE COMPLETE H & M LINE

- PIPE CUTTING & BEVELING MACHINES From 1½" to 36"
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Canned Blasting Agent For Seismic Prospecting

Known as a blasting agent rather than a high explosive because of its relative insensitivity, Petron can be detonated only by a suitable priming charge. Neither blasting caps, detonating fuse, flame, nor impact will detonate Petron itself.

Cans of Petron are designed for fast screw assembly into rigid columns which will withstand much more loading-pole pressure than gelatin charges. The blasting agent can often be loaded into holes which will not accept gelatin charges and drill-hole casings, required by gelatin, are not usually needed when using Petron. It is available in 1-lb. cans of 2 and 2½-in. diameters. In cartons, the cans are already assembled in short columns for easy assembly of longer columns in the field. **Write or call: Atlas Powder Co., Explosives Division, Wilmington 99, Del., for more information on Petron blasting agent.**

OIL and GAS JOURNAL *Showcase* OF NEW EQUIPMENT

Geo-Lab Designed for Field Research

The Geo-Lab combines laboratory and living facilities with a rugged engine and body construction for use in the field. The unit, manufactured in the United States, is mounted on a German-made DKW Auto-Union cab and frame.

The 350-cu.-ft. laboratory-living unit includes a full-length bed, desk and drawing board, cooking facilities, toilet, storage space, and laboratory working space. The unit is only 14 in. off the ground providing easy access and a low center of gravity which enables it to cross rough steep-angle terrain with safety.

DKW's 3-cylinder, 2-stroke engine has only seven moving parts. Engine trouble caused by friction is at a minimum. **Write or call: Flintridge Motor Manufacturing Co., La Canada, Calif., for more information on the Geo-Lab.**

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OIL AND GAS JOURNAL

Showcase

- BULLETINS
- CATALOGS
- BROCHURES

Birdwell Micro-Profile Calipers and their uses in profiling oil and gas wells are presented in a four-page, two-color bulletin. It relates nine ways of using the improved three-arm caliper with three sets of controllable arms of different length. It provides details of automatically recorded profiles and locations of field stations. **Write or call: Birdwell Surveys, Bradford, Pa., for Micro-Profile Calipers bulletin.**

●

M-S-A Lira Infrared Gas and Liquid Analyzers are discussed in the eight-page Bulletin 0705-2. These analyzers can test for a single component in a mixture of gases or liquids. They will continuously monitor selected components in a refining, or petrochemical process stream. The bulletin contains photographs, a two-page schematic drawing, and specifications for both models. **Write or call: Mine Safety Appliances Co., 201 North Braddock Avenue, Pittsburgh 8, Pa., for Bulletin 0705-2.**

●

Trantex Vinyl Tapes, a new eight-page, illustrated booklet, describes the advantages of Trantex polyvinyl tape for covering and protecting pipes, valves, frames, racks, and metal surfaces against corrosion both above and below ground. It explains how Trantex protects and resists corrosion from weather, acids and alkalies, micro-organisms soil chemicals, and stray electrical currents. It is complete with illustrations, technical data, characteristics, and performance specifications. **Write or call: Johns-Manville Dutch Brand Division, 7800 South Woodlawn Avenue, Chicago 19, Ill., for Trantex Vinyl Tapes booklet.**

●

The Story of Business: Large and Small is told in a 32-page booklet. It includes case histories, photographs, and cartoons to put forth the idea that what we have in this country is not big business and little business, but a business establishment in the same sense that we have a military establishment and an educational establishment. Important and interesting statistics are utilized to show the interdependence of

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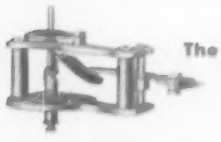
These gearless gages go on performing day in and day out with little or no maintenance. This economy, together with long life, adds up to the fact that HELICOID Gages cost less per gage per year than any other gage you can buy.

Gages for vacuum and compound service. Pressure ranges up to 20,000 psi.



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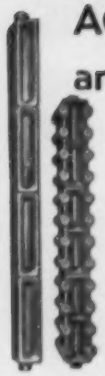

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businesses of different sizes. **Write or call: E. I. du Pont de Nemours & Co., Inc., Wilmington 98, Del., for The Story of Business: Large and Small.**

•

Rayonier Rayflo is the title of a fact sheet about this deflocculent. It is used to control the viscosity and gel strengths of drilling muds. The fact sheet gives chemical characteristics and special uses for Rayflo. **Write or call: Rayonier, Inc., 161 East Forty-second Street, New York 17, N.Y., for more information on Rayflo.**

•

Vol-U-Meter, Meter Separator, Well Tester, Weight-O-Matic Meter, and Metering Free Water Knockout. These pieces of equipment are illustrated and described in the 12-page Catalog C-956. It also covers automatic well-testing systems, automatic custody transfer, and automatic lease equipment. It includes specifications, operating procedures, applications, engineering drawings, and photographs. **Write or call: Oil Metering & Process Equipment Corp., 4843 Yale Street, Houston 18, Tex., for Catalog C-956.**

•

Temperature and Pressure Recorders, (brochure No. 1021) describes the workings and advantages of the filled-tube system recorders and describes six pens. In addition, there are illustrations of recorders including blueprints showing makeup, installation, operation, drawings, and text on the free-friction movement of the pen arms, the rigid girder assembly of the instruments, and the flooded-cup design. The booklet includes information on bulbs and sockets for gas-filled thermal systems, including symbol numbers, materials, and tube dimensions. **Write or call: Burgess-Manning Co., Penn Instruments Division, 4110 Haverford Avenue, Philadelphia 4, Pa., for brochure No. 1021.**

•

Rockwell ER Industrial Meters are covered in the newly revised 16-page Bulletin OG-400. It offers enough additional information on factors affecting meter selection to enable single-plant operators to be self-sufficient in ordering. Included in the new bulletin are more complete temperature, viscosity, pressure, and registration data along with additional illustrations, an explanation of various metering terms, and explicit ordering instructions. The bulletin describes a line of oscillating-piston meters, recommended for a variety of chemicals and industrial liquids. It offers more complete data on meter construction—explaining, with the aid of tables and charts, which case, piston, and chamber are best suited for use with specific liquids. **Write or call: Meter and Valve Division, Rockwell Manufacturing Co., 400 North Lexington Avenue, Pittsburgh 8, Pa., for Bulletin OG-400.**

•

Corrosion Data File. A data file on industrial corrosion and its prevention covers equipment, techniques and economics. Consisting of cathodic-protection articles which have appeared in the trade press, this file collects for convenient reference valuable information on the various types of corrosion and the step-by-step procedure for mitigating its damage to buried and submerged structures, including pipelines, tank bottoms and interiors, oil-well casings, process equipment, steel pilings, bridges, ships, barges, and offshore drilling platforms. **Write or call: Co-reco, Inc., P. O. Box 19177, Houston 24, Tex., for the Corrosion Data File.**

•

Lower Power Costs, an eight-page, two-color booklet, tells how to obtain better power economy through the use of spark-ignition engines. It contains a step-by-step explanation of how engine users can determine if spark-ignition engines will be most economical in their territory and on their application. A portion of the booklet deals with the design features of the Caterpillar D397 and D375 spark-ignition engines. It includes cutaway drawings and tables. **Write or call: Caterpillar Tractor Co., Peoria, Ill., for Lower Power Costs, Form No. D643.**

•

Customized Process Control Instrumentation. This two-color general-stock catalog contains 32 pages. It covers indicating, recording, controlling, and transmitting instruments for flow pressure, and density. Prices, graphs, engineering drawings, and pictures are included. **Write or call: Fischer & Porter Co., 907 Jacksonville Road, Hatboro, Pa., for Catalog 2.**

•

Solids-Contact Reactors. Bulletin 5001 includes a cut-away photograph with plan and elevation drawings showing the wide variety of designs available. The 24-page bulletin discusses theory and problems of cold water clarification, as well as advantages and applications of various designs. Also included is a section on auxiliary and supplemental apparatus. **Write or call: Cochrane Corp., Seventeenth Street below Allegheny Avenue, Philadelphia 32, Pa., for Bulletin 5001.**

EQUIPMENT MEN . . . in the News

American Hoist Names McEvoy as LeBus Manager

J. W. McEVOY

John W. McEvoy has been appointed vice president and general manager of LeBus Manufacturing Co., a new wholly owned subsidiary of American Hoist & Derrick Co., located in Longview, Tex. McEvoy's appointment was announced by R. J. Stoddard, executive vice president of American Hoist & Derrick.

McEvoy was formerly works manager of the American Hoist plant in South Kearney, N. J., and more recently superintendent of structural works in the St. Paul, Minn., plant.

Schroeder Named Cardwell Advertising Manager

A. F. SCHROEDER

The appointment of Allan F. Schroeder as advertising manager for Cardwell Manufacturing Co. at Wichita, Kans., has been announced by J. T. Tucker, general manager of sales for the company. Schroeder joined the Cardwell organization 13 years ago. During that time, he has been responsible for a variety of phases of the company's operations.

Core Lab Expansion Highlighted by Millionth Sample

Core Laboratories, Inc.'s new $115,000 laboratory and office building being constructed at North Young's Boulevard and Northwest Thirty-ninth Street, Oklahoma City.

Core Laboratories, Inc., Dallas, recently analyzed the one-millionth sample to be evaluated since the firm was organized in 1936. With 38 labs now operating on a 24-hour schedule, it was impossible to identify the specific circumstances under which the coveted goal was reached. However, John D. Wisenbaker, president, noted that the event occurred during Core Lab's greatest expansion period.

The company has announced the beginning of construction on a new Oklahoma City building. An architectural innovation will be the use of oil-well cores taken from wells drilled in Oklahoma, to form one wall of the reception room. It will be called The Anadarko Basin Wall, with cores arranged according to geologic age.

Since January 1956, new laboratories have been opened at McAllen, Tex.; Long Beach, Calif.; Kimball, Neb.; and Craig, Colo. Larger and improved facilities have been established in Midland, Shreveport, Tyler, Wichita Falls, Farmington, N. M., and Regina, Sask., Canada. Current construction is under way on a new laboratory in Hobbs, N. M., which will replace operations in Lovington and on a $115,000 laboratory and office building in Oklahoma City.

In addition to the building program, the company has expanded its research, engineering and consulting and special core-analysis personnel and facilities.

Directed by J. W. Barbour, Jr., district manager and vice president, the new Oklahoma City installation will continue to serve as a base point for other labs located in Ardmore, Tulsa, Bartlesville, Arkansas City, Great Bend, Liberal, and Wichita Falls.

Larkin Sales Representatives Attend Annual Meeting

About 40 sales-division members of Larkin Packer Co. attended the company's annual sales meeting in Dallas recently. A feature of the 3-day program was a visit by the sales representatives to the new Larkin administrative headquarters and manufacturing plant in Waxahachie, Tex. There, they met with production personnel. Another highlight of the meeting was an awards banquet. The meeting was conducted by Larkin President W. H. Larkin and Sales Manager T. E. Alexander.

Oil-Field Supplier Makes Rigging for Mayflower II

Gourock Ropework Co., Ltd., Port Glasgow, Scotland, for many years a manufacturer of hemp ropes used in oil fields throughout the world, is digging deep into historical records, to insure correctness of ropes the company is furnishing for Mayflower II.

Mayflower II is an exact replica of the original seventeenth century Mayflower in which early pilgrims sailed from England to America. The sailing ship is being built in England and will be sailed across the Atlantic to America upon completion. The undertaking is a goodwill gesture on the part of the people of England toward their American cousins.

Gourock will supply 28 different sizes of rope and over 20 different lays and construction of rope. The four-

strand shrouds will vary in size from 6¼ to 2⅞-in. circumference. The largest rope in the ship will be the 10-in. circumference mainstay of 9-strand cable construction.

Schlumberger Announces Personnel Changes

E. L. Britt, F. J. Sander, and D. M. Quillan have been named by Schlumberger Well Surveying Corp. to the relatively new position of division engineer.

Britt is named for the South Texas division at San Antonio; Sander for the northern Rocky Mountain division at Billings, Mont.; and Quillan for the Permian basin division at Midland.

Schlumberger's division engineer is responsible for the maintenance of the more complex electronic instruments and the training of field engineers in the operation and maintenance of these instruments.

Schlumberger also named three location managers: F. M. O'Brien at Cushing, Okla.; A. B. Still at Oklahoma City; and C. E. Tedrow at Pampa, Tex.

New sales engineers are T. E. Surilley at Lake Charles, La., J. D. Cunningham at Gretna, La.; D. D. Fitzgerald at Houston; W. J. Jackson at Liberty and R. E. Wilson at Pampa.

Lyon Becomes Staff Member At Boone & Cummings

L. N. Lyon will head the industrial advertising division of Boone & Cummings. His special field will be pictorial explanation of products and processes. As American industry expands its international markets, pictures that speak a universal language are a necessity in selling goods and services to widely dispersed racial groups.

Lyon's previous employment includes Hughes Tool Co., Hughes Aircraft Strut Division, and most recently, Cameron Iron Works where he served as advertising manager.

GE Creates New Department Headed by H. Van Aken

General Electric Co. has announced the creation of a communication-products department headed by Harrison Van Aken, Jr., general manager. This new operating department, headquartered in Syracuse, N. Y., will absorb functions previously handled by the communication - equipment section. Products of the new department will include mobile radio, microwave radio relay, radio traffic-coordination units, power-line carrier equipment, terminal equipment, and other communication systems.

The announcement was made by Harold A. Strickland, Jr., general manager of the firm's industrial-electronics division. Van Aken previously headed the communication-equipment section.

National Appoints MacLean To Merchandising Products

Robert J. MacLean, Jr. has been appointed assistant sales manager, merchandising products, for The National Supply Co., with headquarters in Pittsburgh. Merchandising products include many thousands of individual items, from more than 8,000 manufacturers, sold through the company's 128 oil-field-supply stores.

MacLean started in the company's first training program in 1948. Since

Now under construction: West Coast Transmission Line

WILLIAMS BROTHERS

ENGINEERS and CONSTRUCTORS

HOT BLDG. • TULSA, OKLAHOMA • CABLE ADDRESS: WILLBROS

New York • Washington • Louisville • Minneapolis • New Orleans

CANADA • BOLIVIA • COLOMBIA • ECUADOR

VENEZUELA • ENGLAND

OIL • GAS • WATER • PRODUCTS PIPELINES • PUMPING STATIONS

1951 he has served as manager of store construction, directing an extensive store building and modernization program.

Reed Roller Bit Makes Division Manager Changes

R. C. GANN

H. B. WILSON

M. F. WRIGHT

R. C. Gann, former eastern sales division manager for Reed Roller Bit Co., has been transferred to Reed's Oklahoma division as its new manager. Replacing Gann in the eastern division is H. B. Wilson, former division manager in Canada. M. F. Wright, special salesman in Oklahoma, has been named sales division manager in Canada. These changes were announced by H. B. Book, Reed vice president in charge of sales.

Gann has been with the Reed organization in the eastern sales division for 15 years. Wilson was employed by Reed from 1935 to 1942 as a salesman in Oklahoma and Illinois. Returning to Reed in 1948, he was located in the Texas Gulf Coast division until his appointment as Canadian sales division manager in 1952.

Wright has been with Reed since 1937. He has spent all of his time with Reed in the Oklahoma area with the exception of a brief stay in the Houston office as sales training supervisor.

Associated Oil Field Rentals Honors Mitchell

Dale Mitchell, famous Brooklyn Dodger outfielder, shown in the Houston warehouse of Associated Oil Field Rentals, with whom he is now associated as special sales representative. An open house held in his honor recently at the Houston headquarters was attended by prominent oil men.

Oilwell Names Wells as Farmington Store Manager

The employment of Aubra P. Wells as manager of the Farmington, N. M., store of United States Steel Corp.'s Oil Well Supply Division has been announced by William Miskimins, manager of Oilwell's Central Midwest area.

Wells previously was employed by Oilwell from 1944 to 1948 in various sales and managerial positions.

Weatherford Officials Attend Management Courses

H. A. THOMPSON

E. D. MILLER

R. O. ISHAM

American Management Association courses recently held in New York were attended by three Weatherford Oil Tool Co. officials. Participating in the management course was H. A. Thompson of Oklahoma City, Weatherford's northern division manager.

E. D. Miller of Houston, distribution control supervisor, attended a seminar on improving warehousing and distribution. The second and final workshop of the seminar on financial planning and control as a tool for top management was attended by R. O. Isham, Houston, Weatherford's legal and capital custodian.

J & L Appoints Gray As Clay City Manager

The recent appointment of Donald R. Gray as local manager of Jones & Laughlin Supply Division's store at Clay City, Ill., has been announced by A. G. Bastian, manager of field sales division.

From 1949 to 1952 Gray served as

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UNUSED

6X6 ARMY TRUCKS

2½-ton GMC & International

- **From Government Storage!**
- **Unused and Guaranteed!**
- **Factory New Condition!**
- **Reconditioned Trucks also Available!**

Save up to $3,000 on one of our unused Army trucks. See for yourself how TWO of our trucks cost you even LESS than *one* new truck.

Compare our Tandem Axle Trucks with front wheel drive, 10 forward speeds, overdrive and new mud and snow tires with similar equipment elsewhere.

Investigate now! . . . There's no obligation . . . and we deliver on approval!

For Specifications, Prices, Delivery Write, Wire or Phone Collect—JAckson 5-7841
MILTON Y. TOOMBS, JR.
Sales Manager

MEMPHIS EQUIPMENT Company
CONSTRUCTION AND AUTOMOTIVE EQUIPMENT AND PARTS
766 SO. THIRD ST. MEMPHIS, TENNESSEE

INCREASE PRODUCTION

CLEAN OUT CHOKING SAND

Excessive sand and sediment holds back your oil. For fast, easy clean out with fewer round trips and less downtime, use world famous Miller Sand Pumps.

Write for descriptive price list.

SAND PUMP SIZES IN STOCK
O.D.—2½, 3, 3½, 4¼, 5, 5½, 7 in.
Lengths—20, 25, 30 ft.

Composite Catalog Page 3369

MILLER SAND PUMPS

MILLER SAND PUMP CO.
General Offices, Box 4516
Oklahoma City 9, Okla.
EXPORT OFFICES
30 Rockefeller Plaza
NEW YORK 20, N. Y.

a storeman at Salem, Ill., then was transferred to St. Elmo, Ill., where he served as storeman until his promotion.

McCullough Opens New Branch at Medicine Lodge

McCullough Tool Co. has opened a new branch at Medicine Lodge, Kans., under the direction of W. R. Schuman, formerly of Great Bend, Kans. The company is equipped to provide radiation logging, bullet and jet perforating and all types of wire-line services at this new location.

Medicine Lodge will be under the supervision of G. A. Shidell, district manager, with headquarters at Oklahoma City. McCullough Tool now provides oil-field services from over 70 branch locations in the United States and Canada.

Spartan Trailers Assist Phillips' Dealer Development

To accelerate its dealer-development program, Phillips Petroleum Co. selected the mobile home division of Spartan Aircraft Co., Tulsa, to assemble this fleet of Spartan trailers equipped for classroom-instruction purposes.

As the Phillips 66 dealer network expanded, the Bartlesville, Okla., company's sales management recognized the importance of getting across the story of good management, as rapidly as possible, to dealer personnel. The traveling classroom as offered by Spartan, contributed several advantages to the dealer-development program, including ready-made and better facilities than might be found at the local level and stimulation of public and dealer interest by the fleet's travel on highways and stops at dealer stations.

Defenbaugh Joins C-R-C

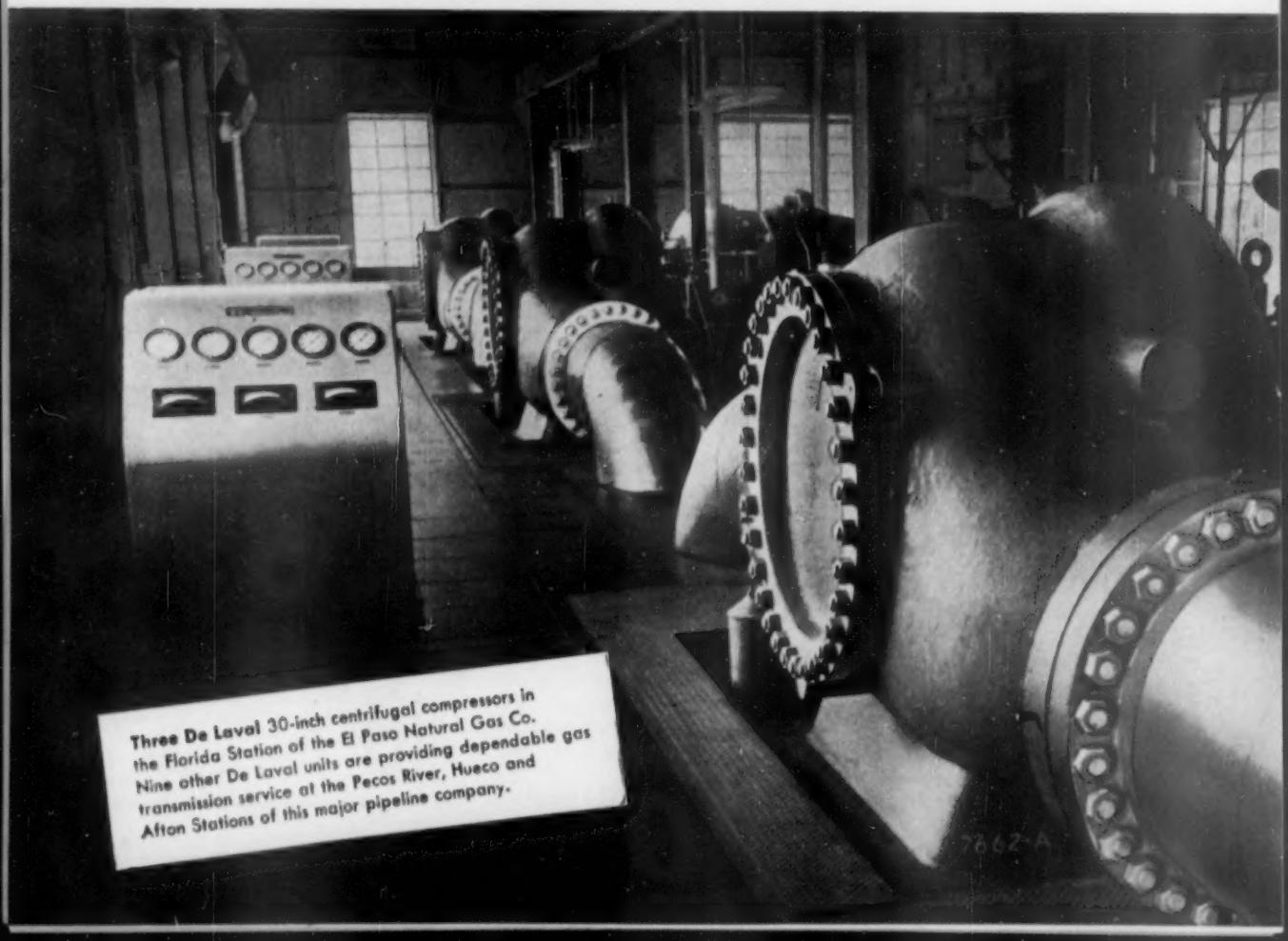
Crutcher - Rolfs-Cummings, Inc. of Houston has acquired certain manufacturing rights formerly held by Industrial Machine Co. of Oklahoma City. Under the new arrangement, Ken Defenbaugh, formerly a partner at Imco, is now with the C-R-C organization.

C-R-C, distributor of Koehring excavators, Parsons trenchers, Esco points and buckets, as well as C-R-C pipeline-construction equipment, will manufacture C-R-C Imco pipe bevelers, C-R-C kelly rippers, and a new electro-hydraulic C-R-C line-up clamp.

Drilco Adds Garrett to Midland Research Staff

Bill Garrett has been added to the Midland, Tex., research staff of Drilco Oil Tools, Inc., it has been announced by Stanley Moore, president.

Garrett joins the Drilco staff after



Three De Laval 30-inch centrifugal compressors in the Florida Station of the El Paso Natural Gas Co. Nine other De Laval units are providing dependable gas transmission service at the Pecos River, Hueco and Afton Stations of this major pipeline company.

3 years in design engineering with the PB divison of Byron Jackson. He formerly was with Mission Manufacturing Co. and Security Engineering Co.

Drilco, which manufactures and services oil-well drilling tools, has shops in Midland and Snyder with service points in Odessa, Tex., and Hobbs, N. M.

Oil Well Names Fort Morgan Field Representative

The employment of William H. Ravert as field representative at the Fort Morgan, Colo., store of United States Steel Corp.'s Oil Well Supply Division has been announced by R. L. Armstrong, manager of Oilwell's Rocky Mountain area.

Ravert had 4 years' oil-field-supply experience before joining Oilwell.

Crowe Is Wolverine Tube's Mgr., Industrial Sales

Robert C. Crowe has been appointed manager of industrial sales, according to John M. Dumser, director of sales for Wolverine Tube, division of Calumet & Hecla, Inc. Crowe succeeds E. W. Ervasti who recently became general sales manager of Calumet & Hecla of Canada, Ltd.

Crowe joined Wolverine in 1950. His most recent assignment was sales representative in the Detroit area. His base of operations will be Wolverine's general sales offices located in the Guardian Building, Detroit.

Herb J. Hawthorne Representatives Meet in Midland

District sales and service representatives of Herb J. Hawthorne, Inc., Houston, manufacturers of Blue Demon replaceable blade drill bits, gathered recently in Midland to discuss the company's planned expansion program for 1957.

Standing are: J. L. Patterson, Gulf Coast; J. W. Thigpen, Houston; E. L. Williams, East Texas; Ken Ross, Seismic Service Supply, Ltd., Canada; C. T. Baker, Mid-Continent; Herb Cruzan, Four Corners; Gordon Goodwin, SSSL, Canada; and C. M. Fountain, Rocky Mountain.

Seated: O. B. Ray and Odell Anders, West Texas and New Mexico; Earl M. Weaver, director of sales, Houston; and Carey Gunn, SSSL, Canada.

DE LAVAL

CENTRIFUGAL COMPRESSORS

on the job at El Paso Natural Gas

De Laval centrifugal compressors offer many important engineering features. (1) They are designed to handle an increased ultimate flow, can be quickly converted to larger capacities by replacing the impeller, diaphragm and a few minor parts. (2) The high pressure shaft seal eliminates leakage, consumption of sealing oil is negligible. (3) There is only one moving part—the rotor—which has ample clearance. (4) Units are compact, require smaller foundations and smaller stations. (5) First costs and installation costs are low.

Bulletin 503 gives data on De Laval Centrifugal Compressors. Write for your copy.

DE LAVAL *Centrifugal Compressors*

DE LAVAL STEAM TURBINE COMPANY

810 Nottingham Way, Trenton 2, New Jersey

DL375

USED MOST TO CREATE OIL DRAINAGE SYSTEMS

HALLIBURTON'S **SANDOIL** FRACTURING

A majority of the largest artificial subsurface drainage systems for oil in the history of the drilling industry have been created by Sandoil Fracturing. Drainage systems that have put millions of additional barrels of oil in the tanks of astute oilmen who use this Halliburton fracturing service.

THE REASON: Sandoil Process' unique combination of materials, machines and men.

- ECONOMICAL MATERIALS

  The fracturing and carrying fluid used in the Sandoil Process is an inexpensive, readily obtainable crude, or refinery cut or blend. Resulting economy makes very large-volume, high-rate ("Big Frac") fracturing, with its vastly improved results, economically feasible.

- EPOCH-MAKING MACHINES

  Effective use of these inexpensive fluids to open gigantic pay-zone fracture systems is made possible by Halliburton's unparalleled equipment. Top-volume pumping units that deliver most efficient hydraulic (in-the-formation) horsepower. Exclusive, continuous, high-rate, variable-ratio proportioning units that "spudded in" a new era of formation fracturing.

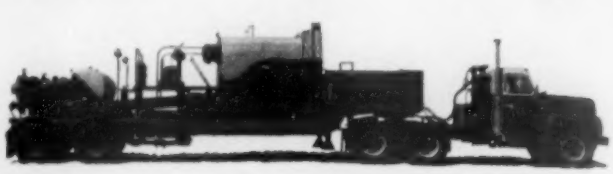
- SKILLED MANPOWER

  Behind the thoroughly trained operators who use the Sandoil Process to create vast "oilsheds" in productive formations... stand seven years of Halliburton Fracturing... thirty-three years of Halliburton research and experience on more than three million well jobs.

- ASK HALLIBURTON

  To apply this powerful combination to the improvement of your production profits, call your local or district office of the Halliburton Oil Well Cementing Company, Duncan, Oklahoma.

COMPLETE DATA SENT ON REQUEST
Ask for "Elements of Hydraulic Fracturing" and other valuable information.



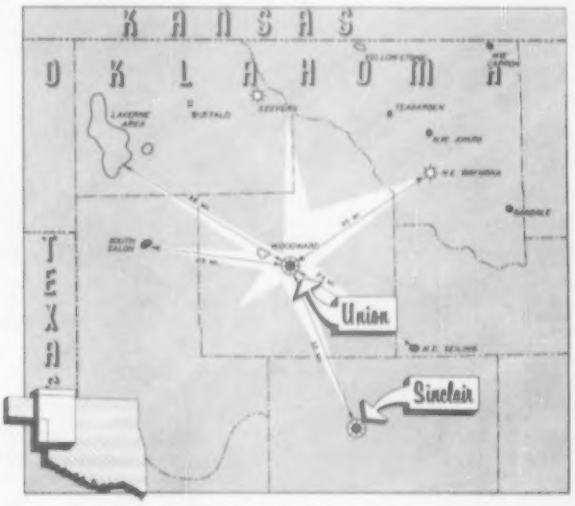
HALLIBURTON

FRACTURING SERVICES

251 SERVICE CENTERS—JUST MINUTES AWAY FROM ANY RIG

Want to Find Oil? Try the Three G's

by Frank J. Gardner



A new regional trend takes shape as . . .

Union Oil Co. of California makes an important Morrow sand discovery to give Woodward County, Oklahoma, its first production.

YOU hear about an important new discovery, and off you go to Union Oil Co. of California. As you walk in, you're greeted by three grinning geologists. You think to yourself—"These guys have something up their sleeves; this isn't the usual reception an oil editor gets, especially when they know he's going to put the swab on."

But there they stand, happy as can be . . . Buddy Fitts, Hap Glidden, and Martin Borg . . . the three geologists credited with this important new strike.

All of a sudden, the table's covered with logs, maps, and reports. These fellows are eager. Makes you wonder. Then you pop the question . . . yep, it's the one they've been waiting for. How'd you know it was the one they wanted you to ask first?

But you ask it anyway. "What's the background here, fellows? This a seismic prospect?" There go the grins again. Fitts narrows his eyes and relishes his answer. "You can say that this time, Union has an important discovery based only on the three G's," he says.

Three G's? Three grins, you think. No, couldn't be. Before you can ask, Fitts drawls it out: "Geology, geometry, and guts!"

"This is purely a subsurface strike, then?" You feel a little silly after the question is out; after all, the man just told you. But who would step out into the middle of nowhere, in dry Woodward County, Oklahoma, and drill a wildcat without some kind of shooting?

"It was really rather simple," Glidden chimes in. "You see, these deep wells to the south had found the Morrow-Pennsylvanian sands to be thick, porous, and filled with gas and water. The ones to the north, updip, found the Morrow thin, tight, and shaly. Somewhere in between, we pictured a huge wedgeout, a textbook strat trap. So we spotted the 1 McCormick right here, in Section 14-22n-20w, drilled into the Morrow upper section of sand at 8,233-86 ft., and she started kicking gas. We were only using 9-lb. mud, so we raised the mud weight and drilled ahead without testing or coring. Boy, just look at this log. There are three separate sand sections. This upper one, 8,233-86, is the one we've perforated here, at 8,234-44 ft.; it's got 17 per cent porosity and about 12 per cent water saturation. This middle one, at 8,305-60 ft., has 15 to 18 per cent porosity and 50 per cent water, 50 per cent hydrocarbons. And this lower one, at 8,394-8,464, has 20 per cent porosity with water and hydrocarbons undetermined. We drilled her on down to 8,494 ft., 20 ft. into the Mississippian, and set pipe."

"Yeah, and we perforated right through the tubing . . . we were that confident," Fitts added, "and we made it a permanent-type completion!"

Gee, these guys **are** confident, you think to yourself. But why not? Here they've accomplished what every good rockhound d r e a m s about. They've found what looks to be a major strat trap filled with gas and 60.5° condensate, and they did it with nothing more than good imaginative discovery thinking. What was that Wallace Pratt once said about oil being found in the minds of men? Well, here it is.

"What really makes this an important well," Glidden pointed out, "is the pressures we've gaged. Up at Laverne in Harper County, bottom-hole pressures are about half that in the Union 1 McCormick; we've got a bottom-hole shut-in reading of 3,995 lb."

"And an initial potential of 25 million cubic feet of gas plus 15.5 bbl. of condensate per million," Borg exclaims. "That's about 388 bbl. a day."

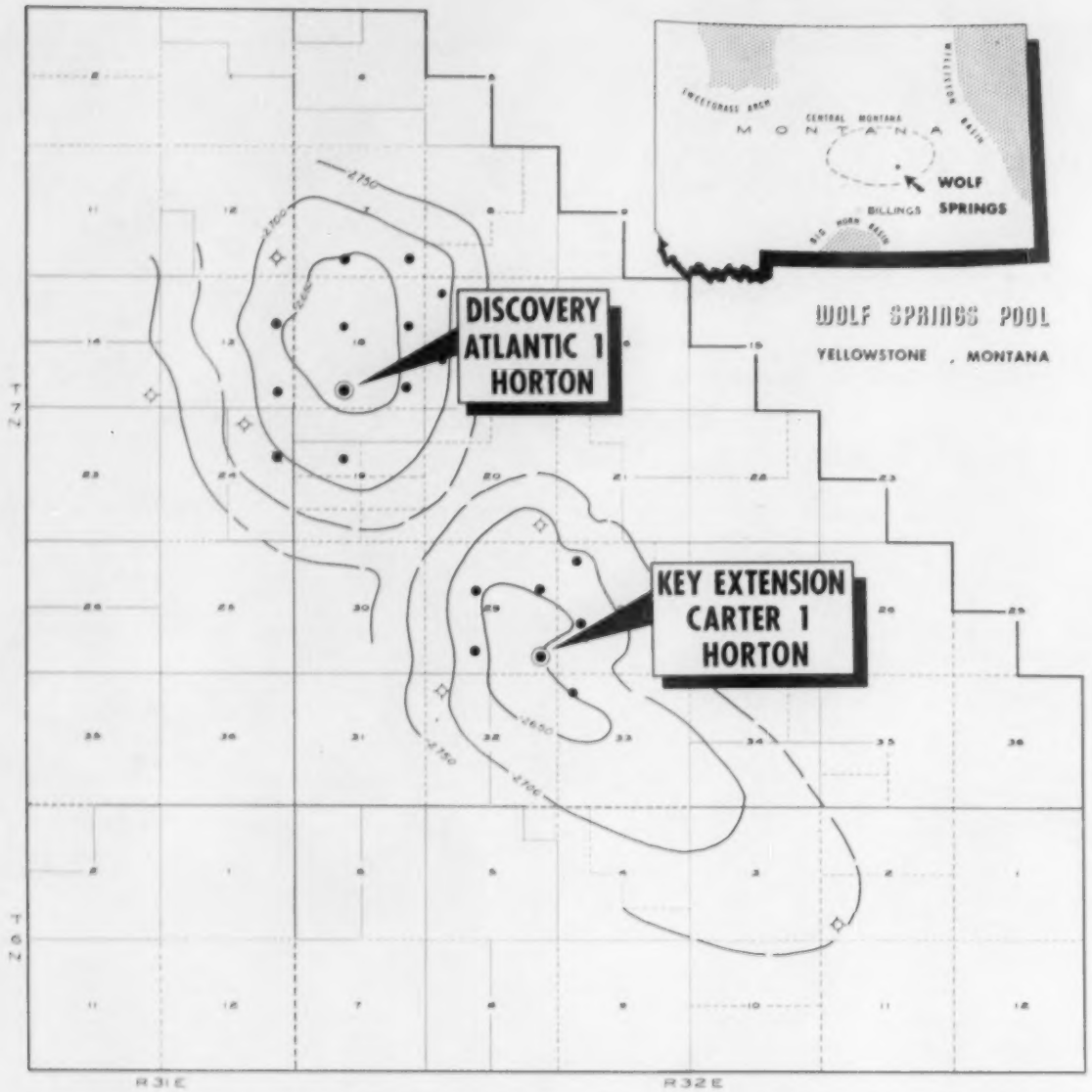
"How big will this thing be?", you ask naively.

"Well, now, you just follow the Canadian River on the map there, clear from Beaver County on down southeast through Harper, Woodward, Dewey, Blaine, maybe even into Kingfisher County. It could extend that far. 'Course, I don't say it **will,** but it **could** be a regional trend that long. At any rate, it's opened up a heckuva lot of acreage all through that country, and leases that were going for a dollar before the strike now go for ten or twenty; why, leases within the discovery township have jumped from 5 to 150 dollars!"

"Looks like Sinclair Oil & Gas Co. is already opening up Dewey County for the first time," you venture, feeling it's a little unfair to sound him out on another company's well.

"Yeah, they think they've got a gas-condensate well in the Cherokee. They didn't find anything in the Morrow, but it, too, is an important discovery, if the 1 Kunc comes in. They carried it clear to 14,467 ft., you know, in the Ordovician. That was a pretty good show in the Cherokee, though . . . 3½ million cubic feet of gas."

As you plod back to the office, you think about those three grins. And those "three G's." And somehow you don't mind that biting north wind. You kinda feel warm all over.



STRUCTURE MAP of Wolf Springs pool, Yellowstone County, Montana, is contoured on the Amsden dolomite. Fig. 1.

Wolf Springs Sparks Central Montana Action

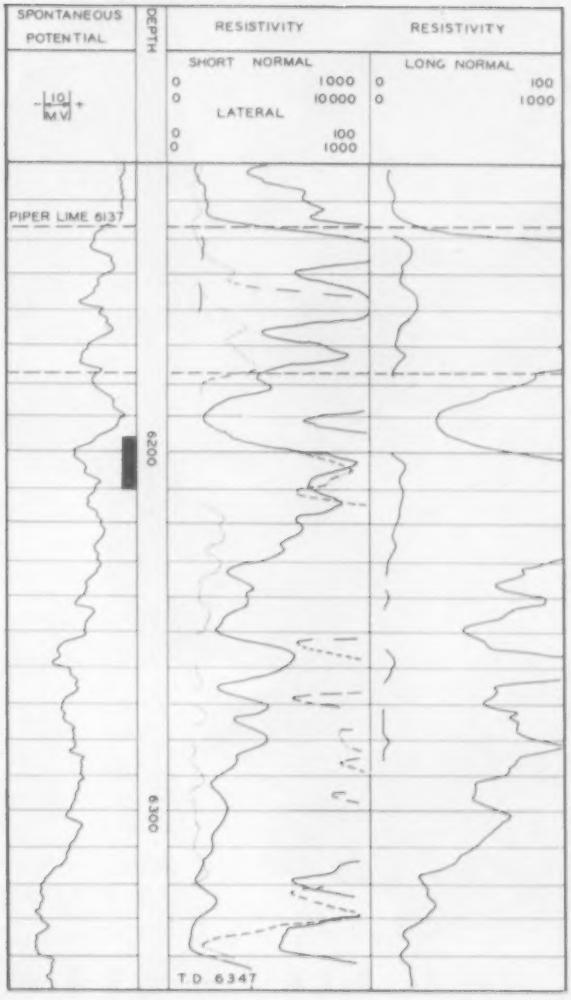
by Norman S. Morrisey
Drilling-Development Editor

Development of Wolf Springs field in Yellowstone County is the most important drilling event in Montana since Poplar field. The exploratory highlight of 1955 in Montana is now the field story of 1956 on the Central Plains.

ELECTRICAL LOG

THE CARTER OIL CO.-C.R. HORTON Nº 1

YELLOWSTONE MONTANA

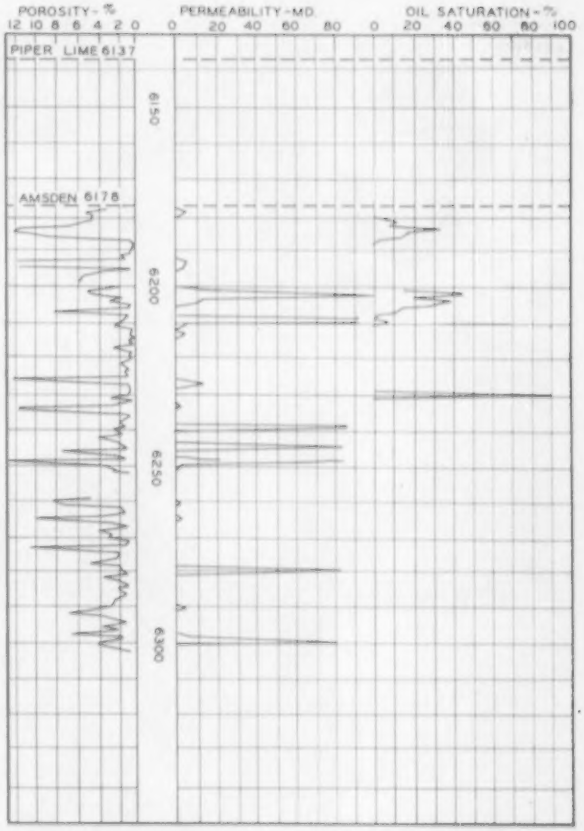


PAY ZONE at Wolf Springs is the Amsden at 6,200 ft. Fig. 2.

CORE GRAPH

THE CARTER OIL CO.-C.R. HORTON Nº 1

YELLOWSTONE MONTANA



DRILL-STEM TESTS are shown at 6,180-88, 6,199-6,201, 6,201-10, and 6,229-30 ft. Fig. 3.

DISCOVERY of Amsden oil at Wolf Springs has made Yellowstone County, Montana, the center of a spirited exploration and drilling campaign. The field was originally discovered in July 1955 with the completion of the Atlantic Refining Co.'s 1 Horton estate. Early in 1956, Carter Oil Co. completed the 1 Horton to extend the field to the southeast.

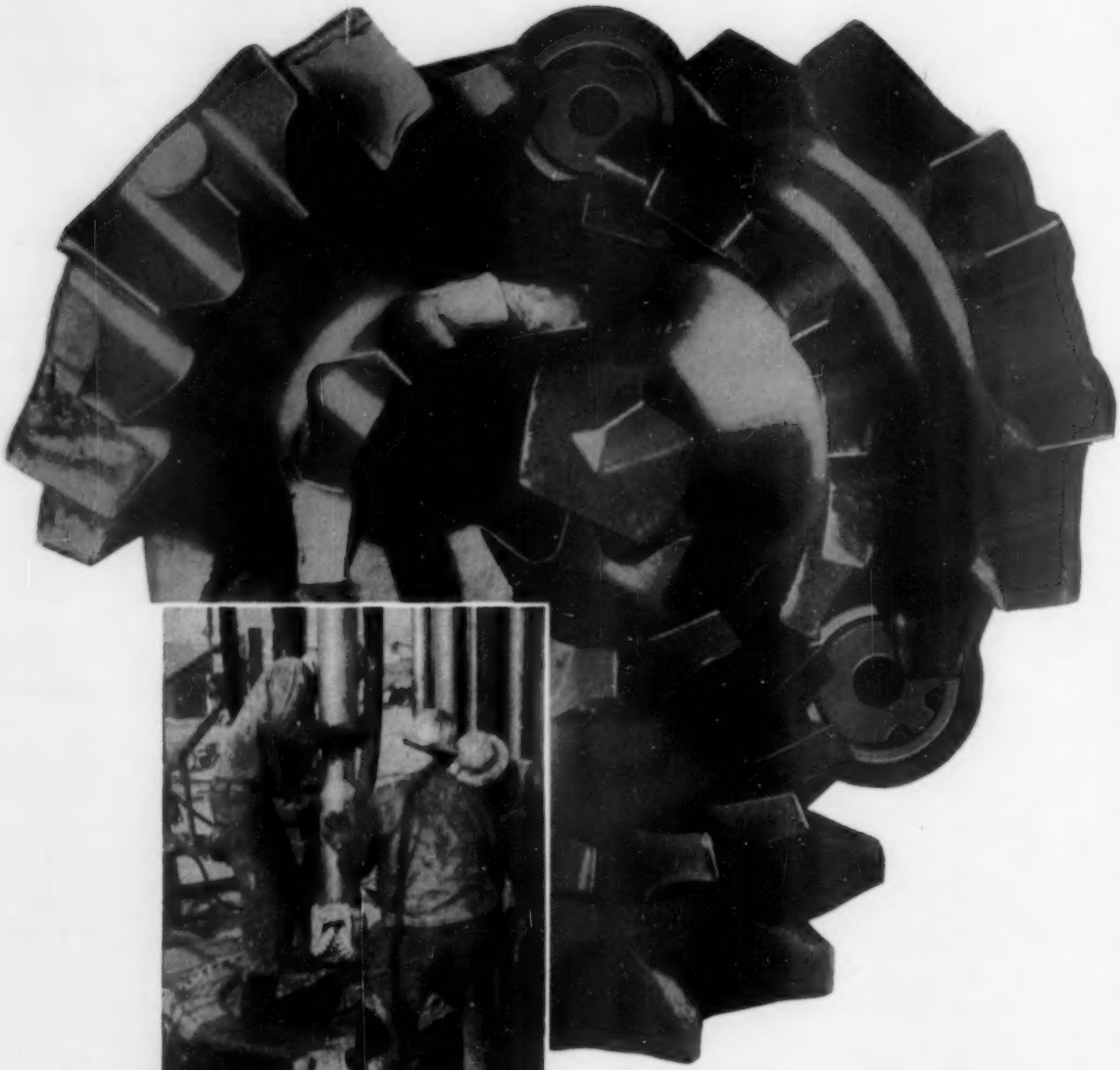
Since its discovery, Wolf Springs has grown rapidly until today it covers 4,250 acres. Production is from the Amsden dolomite and the zone occurs at a drilling depth of 6,200 ft.

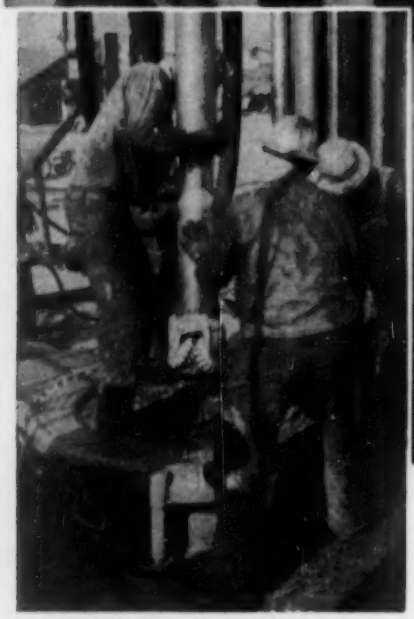
Structure . . . Wolf Springs is a pronounced anticlinal trend that extends northwest-southeast a distance of 7 miles in the subsurface. The anticline is a low-relief feature with only 100 ft. of relief and the maximum width of the producing area is 1½ miles. Geophysical work led to the drilling of the discovery well. According to the latest count, there are 18 producers.

Published data indicate ultimate recoveries at Wolf Springs will be fairly low, probably 2,260 bbl. per acre. Operators have actively campaigned for 160-acre well spacing because of the economics of the reservoir, although the Montana Oil and Gas Conservation Commission has set the spacing at 80 acres. Some engineering estimates of the ultimate recoveries have been as low as 1,000 bbl. per acre.

The reservoir is a fractured limestone or dolomite in the Amsden section. Productivity apparently is related to the fractures rather than to the intercrystalline porosity. Net pay averages 23 ft. from a gross pay section of 42 ft.

Wolf Springs has an active water drive since there is essentially no pressure drawdown.



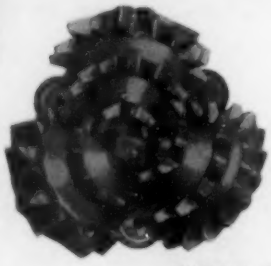


THE FIRST STEP

in making more hole faster!

Competition in drilling oil wells is just as keen and razor sharp as the most competitive selling. Tool pushers are constantly under the gun to complete each well at lowest possible cost. Experienced crews know the first step in lower cost is the very best drilling bit working on bottom.

Globe 3-Cutter Rock Bits are constantly working in all type formations. The increased demand for the Globe "3-Cutter" indicates more and more tool pushers are making the Globe their first choice.



GLOBE 3-CUTTER ROCK BITS

Prompt Service in All Principal Drilling Areas

GLOBE OIL TOOLS CO.
Main Office and Plant:
Los Nietos, California

EXPLORATION HIGHLIGHTS

GREAT LAKES

MICHIGAN

Third Richfield oil well in Grout field, Gladwin County, was under test in pay objective at Sun Oil Co. 1 Cady, NE SW NE 10-18n-2w, Grout Township, the north 40-acre offset to Grout field Richfield zone discovery.

This new producer was perforated in Richfield with 62 shots between 5,035-45 ft. Hole was bottomed out at 5,165 ft., and then plugged back to 5,073 ft. Opened pay was washed down with 100 gal. of acid. Well swabbed acid water and 14 bbl. of net oil on initial test. After being shut in 15 hours, well swabbed and flowed 47 bbl. of oil and a show of water in 8 hours, followed by a flow of 14 bbl. of oil during next 6 hours. Additional testing was in progress. On the basis of these initial tests, the Sun 1 Cady appeared to be the best well to reach Richfield pay to date in the Grout pool.

● New Edmore field well, Home Township, Montcalm County, was completed natural in Traverse pay objective at 3,094 ft., total depth at the restricted rate of 85 to 95 bbl. of oil a day. Well, through a 24/64-in. choke is flowing 6 hours daily, 3 hours in the morning and 3 hours in the afternoon. This new producer is E. Edwin Brehm 1 Long estate, NE NW NW 11-12n-6w. Cable tools were moved to the diagonal southwest 20-acre offset, SW NW NW 11-12n-6w, for next start in the extended pool.

● Sun Oil Co. 4 Hogan Trustee, SE SE SW 8-22n-4w, possible new Richfield oil discovery well, Roscommon Township, Roscommon County, flowed an average 8 bbl. of oil and about an equal amount of water from pay zone on recent tests. Previously well swabbed and flowed from 22 to 29 bbl. of oil a day. The 4 Hogan Trustee, located between Sun's Enterprise Richfield oil pool and the Headquarters Richfield field to the southeast, was bottomed out in Richfield at 5,165 ft. Various pays between 4,932-5,049 ft. were perforated and acidized. Additional testing was in progress.

EASTERN CANADA

Imperial Oil has begun another wildcat well in the St. Lawrence lowlands, it was announced here recently. Lowlands Exploration Co., an Imperial subsidiary, spudded in the wildcat this week near the village of Precieux Sang, about 7 miles southeast of Three Rivers, on the south bank of the St. Lawrence River.

W. A. Roliff, who directs Imperial's eastern Canada exploration work, said the well would be on the farm of Arthur Rheault of Precieux Sang. It is the third wildcat started by the company in Quebec this year. The first, begun last June near Leclercville, proved to be a dry hole. The second, started about a month ago near St. Gregoire, has been drilled to a depth of 100 ft. to date.

The wells are part of an extensive exploration program which the company has been carrying on in Quebec

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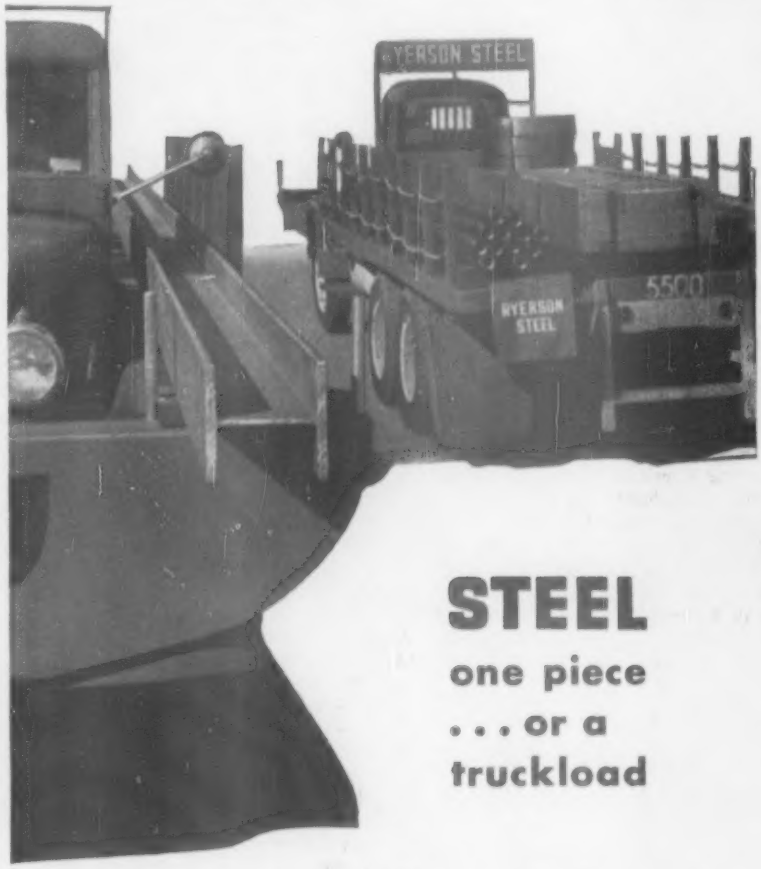

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over the last 3 years. Scientific methods using gravity meters and seismographs led up to the current drilling operations.

APPALACHIAN

OHIO

A north extension into Section 8, Franklin Township, Summit County, by Wiser Oil Co. resulted in a 6,000,000-cu. ft. well after fracture. On 1 Feldman and Hemsby, white Clinton was found at 3,895-3,917 ft. with 1,000,000 cu. ft. natural.

● In Marne pool, Madison Township, Licking County, Waverly Oil Works 2 H. G. Wollard, Lot 3, gaged 450 bbl. and 700,000 cu. ft. gas in 24 hours after fracture from Clinton at 2,653-86 ft.

● An addition to Gratiot pool was completed by Central Ohio Oil on Mount Olive Church, Section 15, Hopewell Township, Muskingum County. Clinton was logged at 3,259-3,313 ft. and made 200 bbl. in 8 hours after fracture with 1,400,000 cu. ft. gas.

● The wildcat on L. M. Boal, Lot 22, Washington Township, Coshocton County, was shut in after fracture at 4,000,000 cu. ft.

EASTERN KENTUCKY

In the Pike County sector of Big Sandy gas field and located on Barrenshe Creek, Columbian Carbon Co. has completed an excellent producer at 1 Hamon Chapman. At a total depth of 2,650 ft. test gaged initially at the rate of 23,000,000 cu. ft. of gas daily from Mississippian Big lime. Pay started at 2,475 ft. with big increase from 2,634 to 2,650 ft. A rock pressure of 763 psi. was recorded in 48 hours.

WEST VIRGINIA

In Sherman district, Hampshire County, West Virginia, Transcontinental Production Co. 1-4 S. T. Haines, deep wildcat, elevation 1,342 ft., was dry after second fracture, Oriskany sand 5,853 ft., with a show of gas TD 6,208 ft.

● Kentucky district, Nicholas County, Rotary Development Corp., is moving in at 1-1 W. L. Evans, rank wildcat, elevation 2,400 ft., Richwood Quadrangle, 4.80 miles south of latitude 80 degrees 30 minutes.

PENNSYLVANIA

In East Whitfield Township, Indiana County, Southwest Pennsylvania, Columbian Carbon Co., is moving in at a new wildcat location 1-1839 Sam Hutchison.

● Young Township, T. W. Phillips Gas & Oil Co. 3 Fee (Neal surface) is drilling at 7,472 ft., Onondaga recorded at 7,398 ft., chert 7,424-47 ft., with gas gaging 2,620,000 cu. ft. Manufacturers Light & Heat Co. 1 R. & P. Coal Co., elevation 1,182 ft., shut down at 7,711 ft., chert 7,465 ft., gas 7,530-40 ft., gas testing 152,000 cu. ft. No Oriskany sand was recorded.

EASTERN INTERIOR

ILLINOIS

One New Oil Pool in Illinois in November

One new oil pool, Hornsby South in Macoupin County, was discovered in Illinois in November, according to the State Geological Survey Division of the Department of Registration and Education. Estimated oil production for the month is 7,101,000 bbl., or an average of 237,000 bbl. per day.

In addition to the new pool, two extensions to pools (Fishhook gas in Adams County and Hilery Consolidated in Edwards County) and four new pays in pools (Pennsylvanian sandstone in Sorento Consolidated in Bond County, Renault sandstone in Whittington West in Franklin County, and Cypress sandstone in Rural Hill North and Warsaw limestone in Dahlgren, both in Hamilton County).

Drilling, which had been running ahead of last year, has slowed down. In November 257 wells were completed, an average of 64 per week, as compared with 73 in October and 79 in October of 1955. The 257 completions included 103 oil wells, 5 gas wells, 76 pool dry holes, and 73 wildcats. Only 45 per cent of the November wells were successful; this percentage is normally about 55.

Pool development drilling in the Cooks Mills-Bourbon area has slowed down as the pools have begun to be drilled up. However, there is still considerable exploratory drilling in Douglas County; 11 wildcat wells were completed in November.

Drilling is at present scattered throughout the state, with little or no concentration in any county or pool.

PACIFIC COAST

CALIFORNIA

A Yearend Rundown On West Coast Strikes

San Joaquin Valley . . . The big news in this region this year has been the virtual lack of any discoveries of real significance, save one. Union Oil Co.'s Stenderup pool find in October, 2 miles west of the town of Arvin in southern Kern County near the Mountain View field, was brought in flowing 1,440 bbl. of oil per day, gravity 27.5°. Production is from the Derby sand at 9,535-9,717 ft.

First offset to the discovery has been completed to the northeast. The Stenderup discovery is important because it opens up an apparently prolific new pool. One drawback, however, to any drilling boom is the fact that Union has a 4,500-acre block around the discovery which shuts out other operators.

Coastal region . . . The big news in the Coastal region is the activity along the Oakridge fault in Ventura County. There are 15 rigs drilling for Pliocene production under the fault. Ten rigs are working in the discovery area at Bridge area-South Mountain field.

Another important coastal find this year was made by Standard Oil Co. of California in September at its McInnes pool extension, Oxnard field, more than 1 mile southwest of regular field production. The discovery well, 1 Diedrich Community, flowed 467 bbl. of oil per day, 27.8° gravity from 6,220-6,325 ft. The first northeast offset has been completed with similar production rates. This one is important as it gives operators further control in their search for Sespe formation production in the Oxnard basin.

Earlier this year Richfield Oil Corp. spent more than 3,000,000 dollars in leases and drilling costs in an unsuccessful search for Sespe production in the town of Oxnard, just 1 mile northwest of Standard's new production. This area is very tricky, geologically, but pays off well when found productive.

Los Angeles Basin . . . Big strike here this year, in terms of drilling, is the deeper Santa Fe Springs field, Santa Fe pool discovery earlier this year. This activity, which once saw 22 rigs at work, was touched off by General Petroleum Corp.'s 243 Santa Fe. This well flowed 1,187 bbl. of oil per day, 33.3° gravity, from selectively perforated intervals between 8,050 and 9,010 ft.

There are 30 wells producing 3,500 bbl. per day. Production peaked in August at 5,500 bbl. per day. Santa Fe pool has been pretty well defined and drilled up, but a well on the west end, completed by Edward Nipple, indicates by its depth that it will probably be an extension of the Santa Fe pool and could touch off a new drilling spree in this old field.

Another big discovery this year is

The Texas Co.'s Southeast area find in Honor Rancho field in May in the Tehachapi Mountains between the Los Angeles Basin and the San Joaquin Valley in Los Angeles County. Texaco and Superior Oil Co. are the only two operators in the new area. Five wells have been completed in this area at rates in excess of 1,000 bbl. per day. These wells maintain high production rates without difficulty.

One of the most productive discoveries this year is Union Oil Co.'s Miocene 8 find in Dominguez field, Los Angeles County. Union completed 139 Callendar for 797 bbl. of 30°-gravity oil per day last March. The interval is 7,435-8,269 ft. Union now has 17 wells producing 2,455 bbl. per day from the new pool.

One other 1956 operation in California in the Los Angeles Basin is Signal Oil & Gas Co.'s extension of Torrance field by drilling out under the Pacific Ocean from an onshore site at Redondo Beach. The concensus is that Signal's wells, now totaling five, are extensions of Torrance field, but they have been officially designated as being in a new pool or area with an offshore designation. The wells are bottomed nearly ¾ mile west of the nearest Torrance field onshore well. The first well drilled from the onshore site by Signal was completed in April flowing 172 bbl. of 25.6°-gravity oil from perforations at 2,850-3,098 ft. Under terms of the agreement between Signal and the city, Signal can drill only one more well in the pool from the onshore site and then must build an artificial island offshore for any further drilling.

Nepple Starts Production Tests on Santa Fe Wildcat

Edward Nepple completed water shut off tests on his new fault block discovery, 1 SP-Pedro-Nepple, on the extreme west flank of Santa Fe Springs field, Las Angeles County, was getting ready to start production tests. On an earlier formation test of the interval 9,832-10,152 ft. with a 700-ft. cushion, gas surfaced in 5 minutes. In the 6 hours the test was open it had a 6,220 ft. rise including the water cushion. 5,160 ft. of oil gas-cut mud and 360 ft. of 36°-gravity crude. Fluid did not surface. Nepple has set a bridge plug at 9,705 ft. and was preparing to perforate the interval 9,430-9,800 ft. for the production test.

Nepple has staked two more locations for deep zone tests in this old Los Angeles Basin field. One is 1,500 ft. north of the new fault block discovery and the other more than ½-mile southeast of the discovery. Both are west of the Santa Fe Zone area which had a drilling boom earlier this year.

Monterey Puts Platform to Work

Monterey Oil Co., as operator for itself, Humble Oil Refining Co. and Seaboard Oil Co., has put its Gulf-type drilling platform to work on a corehole program on their 2-sq. mile tidelands lease 1 mile offshore from Huntington Beach. Monterey plans to use the platform to gather stratigraphic information to be used in locating artificial drilling islands for actual development of the lease.

HUGOTON EMBAYMENT

SOUTHWEST KANSAS

Another Inside Hugoton Oil Strike Indicated

Helmerich & Payne, Inc., are assured of another oil discovery inside Hugoton field gas production.

The 1-30 U.S., NE NE SW 30-26s-34w, southwestern Finney County, recovered 1,260 ft. of oil and 270 ft. heavily oil and gas-cut mud on a test of the Mississippian at 5,122-64 ft.; recovery in the Marmaton-Pennsylva-

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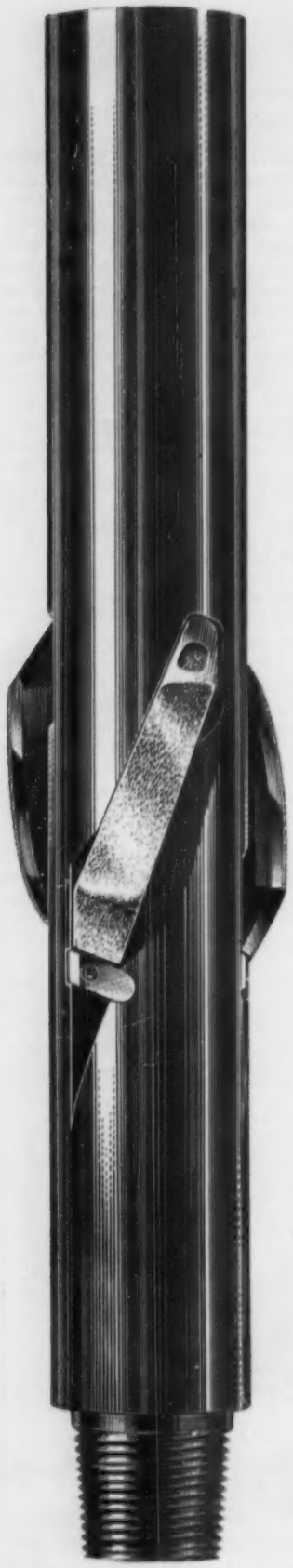

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Helmerich & Payne, Inc., are opening another Mississippian oil pool inside Hugoton field at 1-30 U.S., southwestern Finney County.

nian at 4,125-4,210 ft. was 10 ft. of oil, 1,040 ft. of heavily oil and gas-cut mud and water; test of the Morrow at 4,947-74 ft. got 90 ft. of oil-cut mud.

This discovery prospect is 2½ miles northwest of Pleasant Prairie pool in Haskell County and 2½ miles southeast of South Side pool in Kearny County.

NORTHWEST OKLAHOMA

Northwest's Wildcat Future Is a Bright One

New discoveries in northwestern and north-central Oklahoma assure the state an active accelerated wildcat campaign in the next few months. Only two counties in the entire Anadarko basin are not due wildcat drilling in the coming weeks, Custer and Major.

Woodward County . . . The most significant discovery in the Hugoton embayment province this year is Union Oil Co. of California's big Morrow gas-distillate hit near the city of Woodward in a previously nonproductive county.

The 1 McCormick, SE SE NW 14-22n-20w, indicated on tests a maximum open flow capacity of 100,000 M.c.f. of gas per day from perforations in the Morrow - Pennsylvanian sand at 8,332-44 ft. The well flowed 10,000 M.c.f. per day on choke on final tests. Location of this important discovery in remote wildcat country is 35 miles southeast of Morrow production in Harper County's booming Laverne district.

Harper County . . . The Eason Oil Co. team have two discoveries in this county. The 1 Price, C NE SW 21-26n-23w, flowed oil at the rate of 8 bbl. hourly on test of the Tonkawa sand at 5,495-5,508 ft. The 1-C Hovey estate, C SW NW 36-25n-23w, flowed 2,800 M.c.f. of gas per day from upper Chester-Mississippian at 7,425-7,515 ft.

Sun Oil Co. extended Northwest Laverne field at its 1 Vanscoyoc, C SW NE 13-26n-26w, flowing 6,900 M.c.f. of gas per day plus 8 bbl. of distillate per million from the Chester through perforations at 7,044-7,139 ft. The Hoover sand zone in this same well flowed 17,200 M.c.f. of gas per day plus 5½ bbl. of distillate per million on tests at 4,186-4,206 ft. The Laverne district is rapidly filling up Sections 10-26n-25w and 24-26n-25w. Drilling is expected to remain firm.

Beaver County . . . Union has another discovery in the Oklahoma Panhandle at 1 George, SW SW NE 2-2n-20eCM, northeast of Carmick field.

Shell Oil Co. has an indicated extension to its recent discovery in 24-3n-25eCM. The 1 Atkins, 25-3n-25eCM, flowed 1,200 M.c.f. of gas per day from the Tonkawa sand at 5,563-5,618 ft.

New-pay discoveries are reported from South Greenough and East Forgan fields. Cities Service Oil Co. 1 Beard-A, C SW NE 8-5n-22eCM, flowed 8,700 M.c.f. of gas per day from the Chester lime at 6,512-27 ft.; from the Morrow sand it made 110,000 M.c.f. per day at 6,305-26 ft. The new pay at East Forgan is the Chester, dis-

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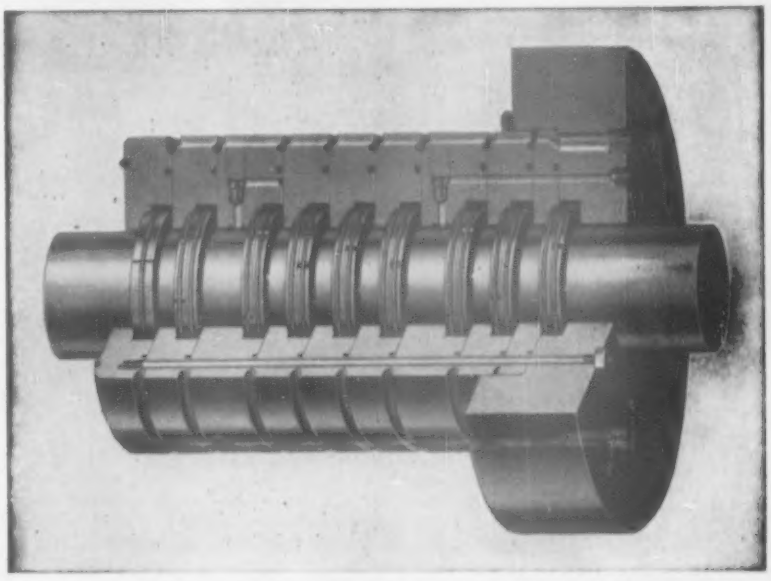

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covered at The Texas Co. 1 Hinkle, SE SE NW 18-5n-24eCM. The well flowed 5,010 M.c.f. per day from perforations at 6,396-6,475 ft.

OKLAHOMA PANHANDLE

Inside Hugoton Strike Is Dual Discovery

Panhandle Eastern Pipe Line Co. shut in its O1 Wilson inside Hugoton field, C W½ SE 23-4n-13eCM, 14 miles north of Goodwell, Texas County. The dual discovery flowed oil at the estimated rate of 140 bbl. per hour from perforations in the Keyes sand at 6,441-70 ft.; gas from 6,470-72 ft. in the Toronto measured 6,000 M.c.f. per day.

MID-CONTINENT

OKLAHOMA

Ordovician Sands Tested At Cleveland Wildcat

Production tests of the Bromide and Tulip Creek sands were reported at Anderson-Prichard Oil Corp.'s Noble townsite discovery in NE NE SW 27-8n-2w, Cleveland County.

The 1 Allison flowed 301 bbl. of new oil in 15½ hours on 16/64-in. choke from Bromide sand perforations at 7,900-05 ft.; the Tulip Creek perforations at 8,210-15 ft. netted 173 bbl. of new oil in 13 hours on 11/64-in. choke.

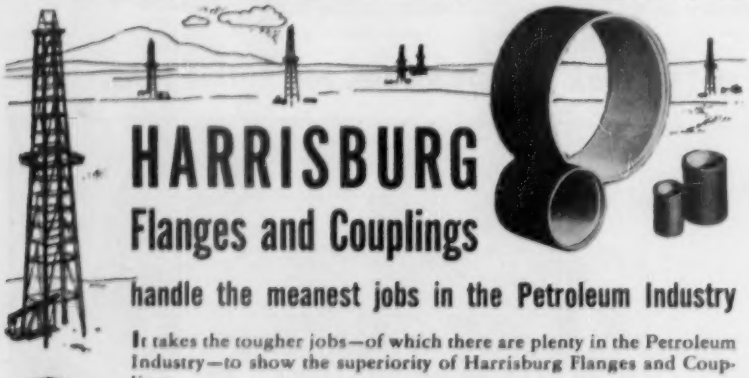
Production Tests Due At Love County Strike

The Texas Co. is taking production tests at its Love County discovery, the 1 Westheimer, NW SW NW 17-7s-3e. The well flowed 9,600 M.c.f. of gas per day plus 182 bbl. of condensate and some mud in 20 hours. A later gage made 196 bbl. in 4½ hours and 224 in 16 hours. Pay is from open hole in the Oil Creek lime.

Big Flow Reported In Southwest Bradley

Ohio Oil Co. 1 Lodge Unit, C NE SE 4-4n-5w, Southwest Bradley field well, Grady County, flowed 428 bbl. of load and 923 bbl. of new oil in 24 hours on ½-in. choke from first and second Bromide sand perforations at 13,707-888 ft.

Max Pray 1 Mid-Continent-Billy English, C SW NW 3-4n-5w, flowed



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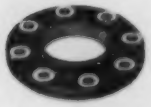

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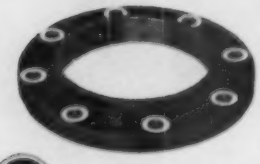

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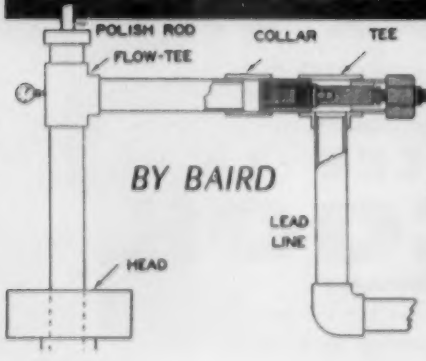

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Northeast Falls Field Extended in Cleveland

The south side of Cleveland County's Northeast Falls field was extended at Atlantic Refining Co. 1 Gray, NW SE NE 29-9n-1w.

The well flowed naturally 116 bbl. of oil in 8 hours on 20/64-in. choke from open hole at 7,250-54 ft. Oil is 35.9° gravity.

South Lone Elm Field Extended

The South Lone Elm field in Noble County, northern Oklahoma was extended by Wilcox Oil Co. The 1 Wilson, SW NW NE 20-20n-1e, flowed 100 bbl. of oil per day on ½-in. choke plus 4,700 M.c.f. of gas per day from perforations in the Cleveland sand at 4,274-88 ft. after fracturing. Other wells in the area have similar production, only all gas. The Hoover sand is a gas producer to the immediate north.

KANSAS

Testing Continues at Harper County Well

Mull Drilling Co. is continuing tests after squeezing off water at its 1 Coryell, C SW NW 9-32s-9w, 2 miles northeast of Sharon pool in northwestern Harper County.

The well is credited with swab test of 2 bbl. per hour, natural.

Hodgeman County Has Indicated Discovery

A new Pennsylvanian pool is indicated at H&H Drilling Co. 1 Goebel, C NW SE 14-21s-24w, 7 miles north of Jetmore in northern Hodgeman County.

A drill-stem test in the Lansing-Pennsylvanian recovered 1,975 ft. of gas and 185 ft. muddy gassy oil.

Rework Well Going On Pump in Pratt

Pratt County has a possible discovery well at an old rework well. K&E Drilling Co. and Bell Oil & Gas Co. are putting up pump at their 1 Eubank, NW NW NW 4-27s-14w, 3½ miles south of Byers, Kans. Tests have been in the Viola lime at 4,378-84 ft. Location is 1 mile north of Blowout pool.

NORTH TEXAS

Tannehill Oil Moves West to King County

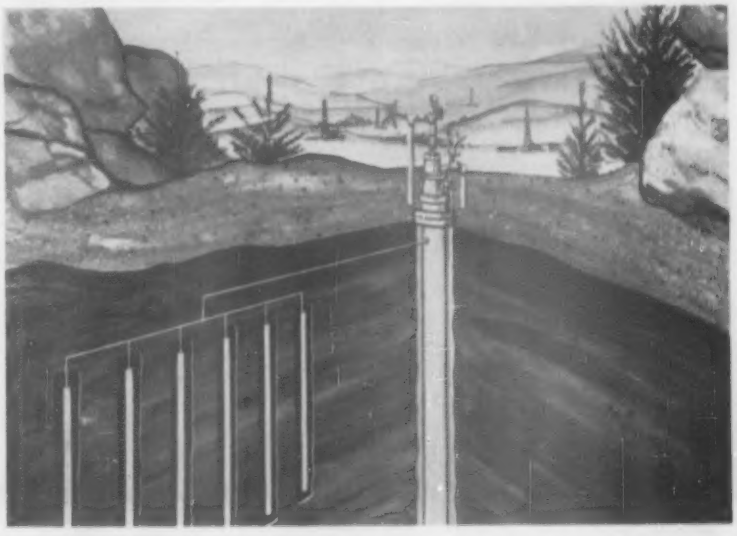
Knox County's rapidly mushrooming Tannehill sand production has been extended westward into King County.

Robert E. Aldrich and Mohawk Petroleum Corp. 1 Ross apparently was the first discovery to be completed in this area. The well swabbed and flowed at the rate of 28 bbl. of oil an hour initially, but could not maintain a steady flow. Pumping equipment was set up and the well made a daily potential of 72 bbl. Pay was the Tannehill sand from 2,726-34 ft.

Location of 1 Ross is approximately 12 miles northwest of Knox City, but in southeastern King County, in Section 96, Block 13, H&TC Survey.

In the same area, Fain & McGaha 1 Ross made pumping potential of 68 bbl. of 36.8° oil, plus 5 per cent water, from open hole at 2,663-71 ft. Gas-oil ratio was 510:1.

The new wells are ½ mile west of the Buzzard Peak field discovery, opened in 1952 for 133 bbl. of oil a day from the Caddo at 5,646 ft. The field



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has had no production reported for the past 2 years.

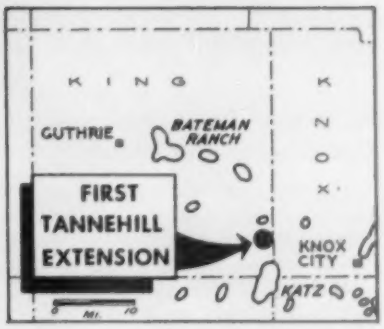
Knox County . . . A discovery and an extension to it have been completed 2 miles northeast of Knox City.

Christie-Stewart 1 C. L. McAfee, in Subdivision 3, D. G. Burnett Survey 9, found top of pay at 2,084 ft. and drilled to 2,088 ft. On potential test the well flowed 101.5 bbl. of 35° oil a day through ¾-in. choke. Gas-oil ratio was 600:1, tubing pressure was zero and casing pressure was 350 psi.

The same operator's 2 McAfee, approximately ½ mile northeast of 1, pumped 122.5 bbl. of oil a day from pay between 2,060-67 ft.

A. H. Bruner & Co., Dallas, has scheduled 14 Tannehill tests, for Knox and Baylor counties. Six tests in Baylor County are in the west-central part of the county, ranging from 8 miles west of Seymour to 4 miles northeast. Depths will be from 1,600-1,800 ft.

Bruner's Knox County tests are 4 to 8 miles north and west of Munday, and 4 to 6 miles west, and northwest, of Vera. Depths will range from 2,000-2,300 ft.



The Tannehill sand drilling boom in Knox County has spread westward into King County. Two wells were completed on W. R. Ross land, west of the depleted Buzzard Peak discovery.

Fisher County Wildcat Flows Strawn Oil

Shell Oil Co. 1 R. W. Callan, 4-3-H&TC Survey, 8 miles southwest of Rotan in Fisher County, made a heavy flow of oil on a drill-stem test in the Strawn at 6,240-62 ft. Top of the Strawn was 6,239 ft., on elevation of 2,014 ft.

On the test, oil flowed in 8 minutes, with ⅝-in. bottom choke. Gaged over a number of 30-minute flow periods, the well tanked 194 bbl. in 3 hours and 22 minutes, cut 7 per cent with sediment and a trace of water. Recovery below the circulating sub included 270 ft. of salt water. Bottom-hole flowing pressure was 1,060 psi. Operators drilled ahead to 6,312 ft. for further testing.

Jones County . . . Great Lakes Carbon Corp. 1 Herron, Subdivision 3, E. Miles Survey 219, has opened two-pay Canyon sand production nearly 1 mile east of Northwest Noodle field. The well is in southwestern Jones County, 13 miles southwest of Anson.

On dual completion the well made 240 bbl. of oil a day through ¼-in. choke from pay at 4,025-41 ft., and through ½-in. choke it flowed 155 bbl. from 4,078-84 ft. Pressures and gas-oil ratios were not reported.

Throckmorton County . . . Payne-Johnston 1 Annette Steadham, Section 248, BBB&C Survey, has been completed as a dual Caddo lime discovery.

The upper zone at 4,510-18 ft. made 120.8 bbl. of oil in 9 hours through 24/64-in. choke, for a calculated 332 bbl. daily potential. Tubing pressure of 200 psi. and gas-oil ratio of 478:1.

The lower zone at 4,804-15 ft. flowed 132.46 bbl. in 9 hours, for a daily rate of 353 bbl., through 18/64-in. choke. Tubing pressure was 455 psi. and gas-oil ratio was 734:1.

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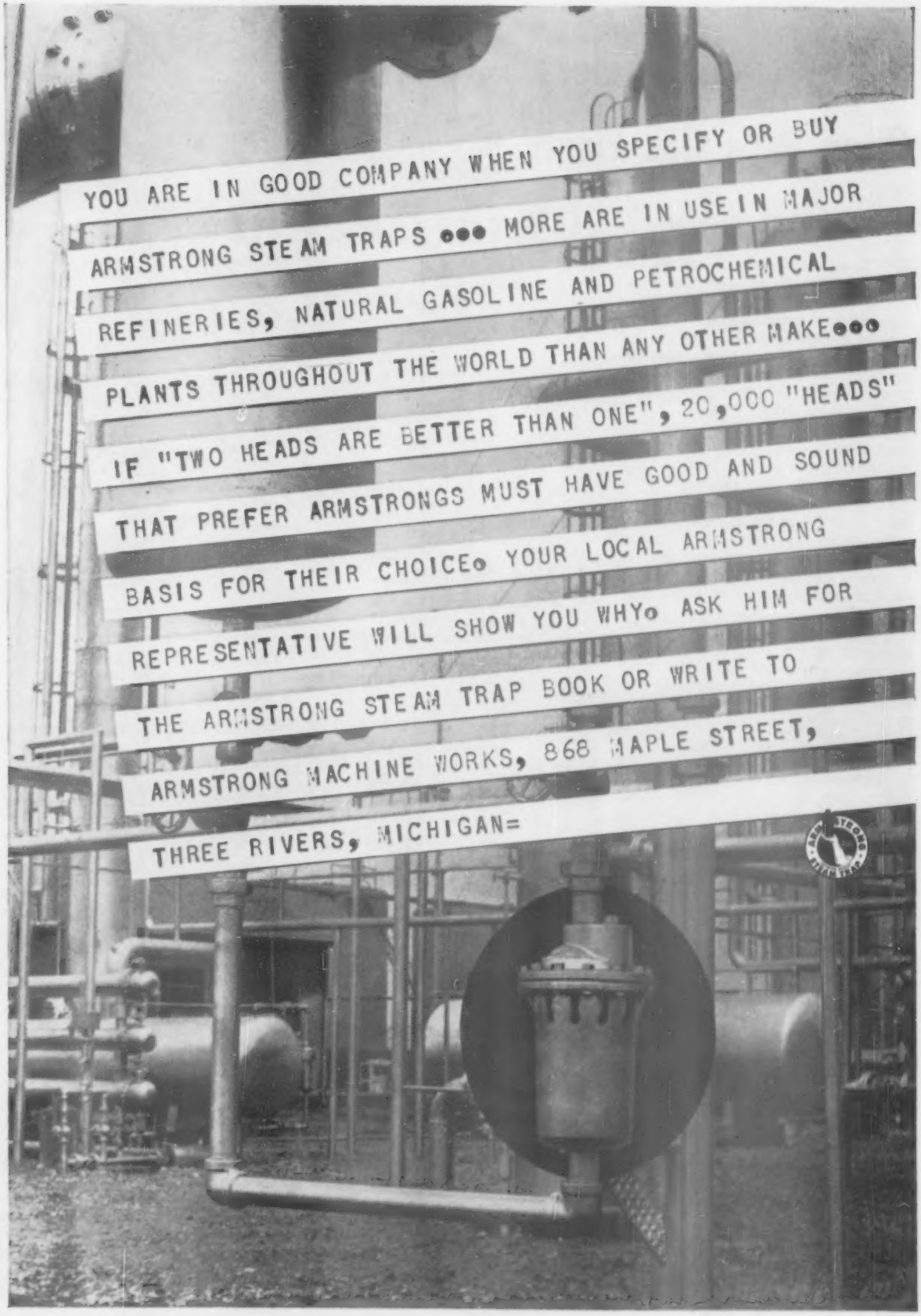
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Pennsylvania Drillers Open New Gas Fields

by Carl H. Roberts

FIVE wildcat completions in the last 6 weeks indicate that the widespread hydraulic-fracturing-stimulated exploratory drilling program in southwestern Pennsylvania is paying off.

Since the discovery of Rockton-Luthersburg and Bell Township gas fields in western Clearfield, Indiana, and Jefferson counties *(The Oil and Gas Journal, October 31, 1955)*, operators have concentrated their exploration drilling in areas underlain by the Onondaga chert section of Lower Devonian age.

Most recently completed wildcat is New York State Natural's 1 State of Pennsylvania, Tract 63 well in Huston Township, Clearfield County. Production from this test (A on map) is from the Oriskany sandstone at a depth of 7,341 ft.

Currently, this well is shut down for fracturing of the chert and Oriskany sections. Significance of this Oriskany production is that it extends the productive limits of the stratigraphic type of trap Oriskany gas accumulation 7 miles northeast of Rockton-Luthersburg field.

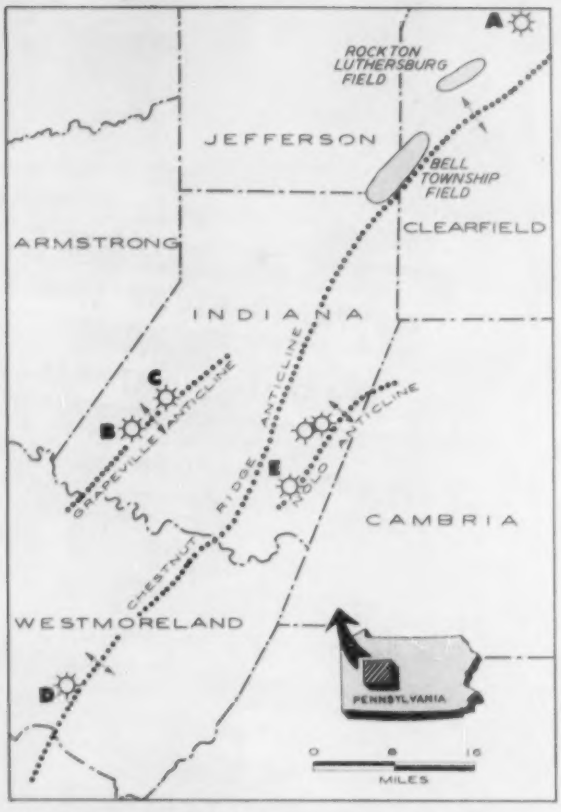
Before this latest discovery Rockton-Luthersburg field extended 4 miles northeast to southwest with an average width of 1¼ miles. Production is from both the Onondaga chert and Oriskany sandstone sections.

Southwest of field . . . Fifty miles southwest of Rockton-Luthersburg field, Manufacturers Light & Heat Co. completed their 1 G. L. Stewart wildcat test (B on map) with an open flow of 8,500 M.c.f.d. after fracturing the Onondaga chert and Oriskany sandstone at a depth of 7,499 ft.

Wellhead pressure is 4,275 psi.

This test is located in Young Township, Indiana County, near the crest of the Grapeville anticline. The chert section of this well is 133 ft. thick as compared with 40 to 70 ft. in western Clearfield and Jefferson counties.

Although only 170 M.c.f. of gas flow was encountered in the Oriskany in this well before fracturing, a confirmation well to this discovery located 1 mile northeast has natural flows of 2,500 M.c.f.d. from the Oriskany, and 2,000 M.c.f.d. from the Bradford sand at a depth of approximately 3,000 ft.



SOUTHWESTERN PENNSYLVANIA where hydraulic fracturing has opened production in areas underlain by the Onondaga chert.

Air-drilling rotaries are now active in . . .

Four miles northeast of this discovery, Columbian Carbon and Keta Gas & Oil Co. completed their 1 Yosurak (C on map) in Armstrong Township, Indiana County, with an open flow of 3,400 M.c.f.d. after fracturing at a depth of 7,802 ft. As in common, only a slight show of gas was present in the chert and Oriskany sections before fracturing.

Onondaga . . . Thirty miles southwest of these discoveries in Mount Pleasant Township, Westmoreland County, the Peoples Natural Gas Co. completed their 1 J. Maley test (D on map) with an open flow of 11,000 M.c.f. daily after fracturing the Onondaga chert section at a depth of approximately 7,400 ft. The chert section in this test is 154 ft. thick.

The Maley well is located near the crest of the Chestnut Ridge anticline, which in this area is a complexly faulted, steeply dipping anticline.

Thirty miles northeast of the Maley well Columbian Carbon-Felmont Oil Corp.'s 1 I. R. Smith test (E on map) in Brush Valley Township, Indiana County, became the third producer on the Nolo anticline.

This well is located 9 miles southwest of the two other commercial producers in this area.

The open flow of this well is 1,800 M.c.f.d. after fracturing the Onondaga chert and Oriskany sandstone sections at a depth of 7,754 ft. Wellhead pressure is 4,250 psi.

A 107-ft. thick chert section was penetrated in this well.

The major significance of these successful wildcats is that they are the first five major wildcats completed in southwestern Pennsylvania since hydraulic fracturing of the Onondaga chert section has become a standard completion practice.

Air drilling . . . Rotary drilling with air continues to be highly successful and at present nine rotary rigs are active in the areas mentioned. However, indications are that this number will be substantially increased in the next 6 months.

Exploration and development of shallow gas sands has also been intensified as a result of hydraulic fracturing, especially in the counties of Armstrong, Westmoreland, Indiana, and Clarion.

The Bradford sand found at depths ranging from 3,500 to 4,000 ft. in these counties responds exceptionally well to fracturing. In many cases, Bradford sand wells that have been producing for 25 to 50 years are reentered and fractured.

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The resulting increase in flow, in most cases, gives the wells a greater daily volume than the original flow when first drilled.

Increases in flows from the Bradford after fracturing are from 18 to 100 times greater than the flow before fracturing and range from 200 to 1,500 M.c.f.d.

The major deterrent to drilling deep test wells in Pennsylvania in the past was that usually no other major producing zones were encountered above the Oriskany sandstone. In southwestern Pennsylvania this meant that Oriskany tests had to be drilled to an average depth of 7,500 ft. with only a very slim chance of obtaining major production from any formation above the Oriskany.

Hydraulic fracturing . . . Hydraulic fracturing has reduced the wildcatter's risk by making it possible to obtain major production from both the shallow sands and the Onondaga chert above the Oriskany. Combine this with fast, economical rotary drilling and a field price for gas of 27½ cents per M.c.f. and it takes no crystal ball to see that Pennsylvania is about to experience a new drilling boom.

ARK-LA-TEX

ARKANSAS

Activities in the gas field which has been opened 10 miles north of Atkins along a belt from west to east entirely across Pope County from Johnson to Conway County are being expanded.

Carter Oil Co. has moved equipment into Granny Hollow, 2 miles south of Jerusalem in northwestern Conway County. The new well will be drilled in 5-8-18 on the same property where large quantities of gas were brought in by this company recently.

Shallow Boom Continues In Stephens Area

The drilling boom in Stephens, Ouachita County, southwestern Arkansas, goes on unabated. About 6 rigs are running inside the city limits and many more are in nearby fields. At least 50 more wells are slated to be drilled either inside the city or in the immediate area.

More than 75 shallow Blossom sand wells have been drilled in the area, and most of them are on pump. Average production from these wells is 25 bbl. after sand fracturing. Only about 6 or 8 bbl. are produced without fracturing.

WESTERN CANADA

SASKATCHEWAN

The Delhi operated venture in southwestern Saskatchewan 1 Garden, on LSD 4, 25-10-20w3, lies on a block of approximately 227,000 acres owned equally by the team. A drill-stem test of the Shaunavon gave up 1,140 ft. of oil and approximately 10 gallons of water. Production casing has been set on the well, it will be completed and further tests carried out on it immediately.

The Bone Creek field, located 4 miles east, produces from the same formation and the four company group now have 26 producing wells in that field. The oil is being sold to the Great Northern Oil Purchasing Co. and is transported to markets through the South Saskatchewan pipeline.

The southeast Saskatchewan well to indicate production, White Rose-Souris-Canadian Superior 3-5 Lightning Creek, on LSD 3, 5-8-32w1, is situated 5 miles northwest of Redvers townsite and 10

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Larkin Regular Concrete Guide Shoe Fig. 202

Amerada Petroleum Corp. will drill a remote wildcat in northern Saskatchewan's Bear River area, NE¼ 32-65-21w2, 18 miles northeast of the north tip of Montreal Lake. The wellsite is in unsurveyed territory on wholly-owned acreage held by Amerada.

miles north of the present limits of Alida oil field. Initial drill-stem test in the Mission Canyon sector of the Mississippian, yielded a sizable pipe recovery of gassy oil as well as salt water and mud, but subsequent "straddle packer" tests in the zone gave up water-free oil. Production casing has been set on the hole and the operator is waiting on service rig to test the wells' potential.

ALBERTA

Savanna Creek Report

Tests of the 3-A Savanna Creek step-out well in the Canadian Rockies southwest of Calgary have assured its backers of another important gas success. The development team is composed of Husky Oil & Refining, Ltd., Northern Natural Gas Producing Co., Phillips Petroleum Co., Canadian Anaconda Oils, Ltd., and Target Petroleums, Ltd. Results of drill-stem tests run to date confirm the presence of one of Canada's largest gas reservoirs. Savanna Creek field has been of major interest since the discovery well was completed in late 1954 because of the spectacular drilling operations in the mountainous country and the large volumes of gas encountered.

The second drill-stem test at the No. 3A well covered the interval 9,480 to 9,613 ft. in the Rundle formation. A water cushion of 1,500 ft. was used and the valve was opened for 2 hours. Drilling mud and water cushion flowed to the surface in 25 minutes followed by a gas flow which increased to a rate of 10.6 million cubic feet per day at the end of the test.

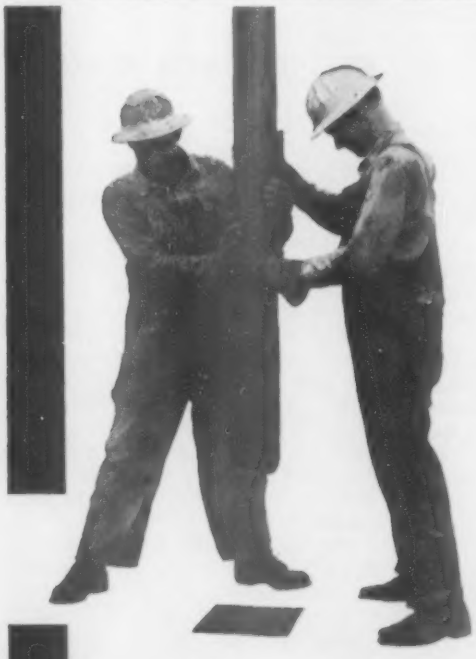
Savanna Creek No. 3A, a 2-mile northerly step-out from the 1 Savanna Creek discovery well, is located in LSD 5, 32-14-4w5 atop Plateau Mountain in the front range of the Canadian Rockies. Its surface elevation of 8,134 ft. above sea level makes it the highest well ever drilled in Canada.

Electric logs of 3A Savanna Creek indicate that this well has found more porosity to date than either of the wells drilled earlier. The first major porosity is encountered about 240 ft. higher in the section than in the discovery well, thereby increasing the amount of closure to approximately 1,650 ft.

The logs also revealed porosity in a higher block of the Rundle which was not tested. A small volume of gas was encountered in this upper block in the No. 1 well and the logs suggest that this zone may be more productive in No. 3A.

At latest report, the well is drilliing ahead and plans call for testing two other porous sections of the Rundle found in the discovery well. After testing is completed, casing will be set through the productive section and the well will be taken to a projected depth of approximately 12,000 ft. to test for deeper production.

The discovery well, 1 Savanna Creek,



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was completed in the Rundle formation after yielding gas on drill-stem tests from four separate intervals at an aggregate rate of over 50 million cubic feet per day. The second well, No. 2A, flowed gas on drill-stem tests at an aggregate rate of 32.6 million cubic feet per day from five separate zones.

A fourth well, A1 Salter, was begun last month at a location about ¾ mile north of No. 3A. Location for the fifth well has been prepared.

Savanna Creek gas field is located on a block of 78,080 acres of crown lands held by the team. Interest is divided 32½ per cent each to Husky Oil & Refining, Ltd., and Northern Natural Gas Producing Co., 27½ per cent Phillips Petroleum Co., 5 per cent Canadian Anaconda Oils, Ltd., and 2½ per cent Target Petroleums, Ltd.

Four Discoveries Spot Western Provinces

Exploratory drilling operations in western Canada during the past week rewarded the backers of four of those wildcats with oil discovery, two each in Alberta and Saskatchewan. The two Alberta tests to yield oil although widely separated, flowed oil to surface from the same zone, namely the D3 reef of Devonian age; while the Saskatchewan discoveries were indicated from the Shaunavon zone in the southwestern sector of the province of the Mississippian limestone in southeastern Saskatchewan.

One of the Alberta strikes was made in the Wimborne district, 18 miles east of Olds town by the team of Canadian Oil Cos., Ltd., and Plymouth Oil Co. The other test in this province to indicate commercial production lies between the Bonnie Glen and Wizard Lake oil fields, already renowned for their Devonian production, but cut off from those areas by dry holes.

The southwesten Saskatchewan strike was made by the team of Canadian Delhi Oil Co., Husky Oil & Refining, Ltd., Phillips Petroleum Co., and Richfield Oil Corp., in the Garden Head area, 4 miles west of production in Bone Creek oil field; while the successful test in southeastern Saskatchewan was drilled by Canadian Oil Cos., Ltd., and Souris Valley Oil Co., Ltd., in the Lightning Creek area, north of production in Alida oil field and situated on acreage acquired by the operator under farmout agreement from Canadian Superior Oil of California, Ltd.

The Canadian Oil Plymouth strike, White Rose-Plymouth 1-4 North Stewart Lake, on LSD 1, 4-33-26w4, lies 4 miles southwest of the B.A.-Mobil 9 Klingstal oil discovery well. Initial test in the reef, covering a 20-ft. interval around the 7,300-ft. mark gave up a gas flow rate measured at over 7,000,000 cu. ft. daily. The gas also showed traces of condensate. Subsequent test, taking in an 18-ft. interval and bottomed at 7,339 ft., flowed oil to the surface and gave up a sizable quantity of greenish oil in the drill-stem. Coring and testing operations are continuing at the well to fully determine the extent of pay zone present at the hole.

The other indicated success in Alberta, Dome-Texaco 1-5 Wizard Lake, on LSD 1, 5-48-27w4, lies 2 miles north of Bonnie Glen field production and 1¼ miles south-southwest of producers in Wizard Lake field. A 20-ft. pay section was indicated in the D3 when initial drill-stem test in the horizon flowed oil to surface 1 hour after the packer was opened. Pipe recovery consisted of oil, oil-cut water and oil-cut mud. The water recovered on that test was part of the water cushion used to control the well during the test. A lower interval indicated the water line had been reached when a drill-stem test gave up a pipe recovery of salt water, oil-cut water cushion and salt water-cut mud. This well has completed drilling operations and production casing is being set, after which production test operations will determine its commercial worth.

WEST TEXAS-NEW MEXICO

WEST TEXAS

Andrews and Winkler Counties Given New Pays

Stanolind Oil & Gas Co. has opened new pay zones at wells in two West Texas fields. One well was completed in a new zone in the Fasken field, while the other made significant recovery on a test from a prospective new zone in the North Monahans field.

Stanolind and others 1 Fasken unit, Midland Farms area, in Section 13, Block 42, T-2-N, G&MMB&A Survey, Andrews County, has been dually completed in the Wolfcamp and Pennsylvanian.

The Pennsylvanian is the new zone, which flowed 283 bbl. of 40°-gravity oil a day through a 12/64-in. choke. It was topped at 8,776 ft.

The Wolfcamp flowed 178 bbl. of oil a day through a 12/64-in. choke and was topped at 8,620 ft. The Fasken unit contains 320 acres, with Stanolind as operator. Stanolind and Anderson-Prichard Oil Co. each has 37½ per cent interest. Fasken Oil Co. has 25 per cent interest.

In adjoining Winkler County, Stanolind extended North Monahans field

by locating the seventh productive or potentially productive zone there.

Stanolind - Sealy Smith Foundation 26A, in Section 51, Block A, G&MM-B&A Survey, reovered 19 bbl. of 42° oil an hour on a drill-stem test.

Recovery was from the Waddell sand, a new zone, at the interval 11,520-11,668 ft. with tool open 5 hours 50 minutes. Operator reversed out 130 bbl. of oil and no water; the well is now ready for a drill-stem test of the Ellenburger at the interval 11,910-12,020 ft.

The Waddell discovery constitutes both a new zone and ½-mile west extension of North Monahans field. Stanolind has full interest in the well and 5,360 acres in the area.

Delaware Basin Wildcat Has Water in Devonian

Shell Oil Co. 1 University "17-A," in southwestern Winkler County, but geologically within the Delaware basin, found oil shows and water in the Devonian at 17,213-17,369 ft. The 5-hour test made a flow of gas and recovered 210 ft. of slightly oil and mud-cut water, 3,760 ft. of water, 990 ft. of slightly oil, gas and water-cut mud, and 450 ft. of gas-cut water. Total depth is 17,369 ft.

New Zones at Bakke Field

Bakke field, (Devonian and Ellenburger) in southeastern Andrews County was assured of two new pays at W. E. Bakke and Choya Drilling Co. 3 V. L. Grady, Section 22, Block A44, PSL Survey, 4 miles southeast of Andrews.

On flow test the well flowed a total of 175 bbl. of oil in 18 hours through 1-in. choke from perforations in the Wolfcamp at 8,514-60 ft. From Pennsylvanian perforations at 8,956-84 ft. it flowed 297 bbl. of oil in 32 hours through ¼-in. choke.

Crane County . . . Gulf Oil Corp. 21 Lea, Ellenburger wildcat 10 miles west of Crane in 47-32-PSL Survey, headed oil and sulfur water on a test at 5,800-85 ft. Oil surfaced in 2½ hours and flowed by heads, being ⅓ oil. Location is over 1 mile south of the Lea multipay field but separated by two deep dry holes.

Goldsmith extension . . . Gulf Oil 797 Goldsmith, eastern extension to Goldsmith (5,600-ft.), apparently has failed to find deep production but has made a heavy flow of oil from the field's regular pay.

Total depth was 11,830 ft., plugged back to 5,750 ft. Production test on perforations at 5,670-5,700 ft. gaged

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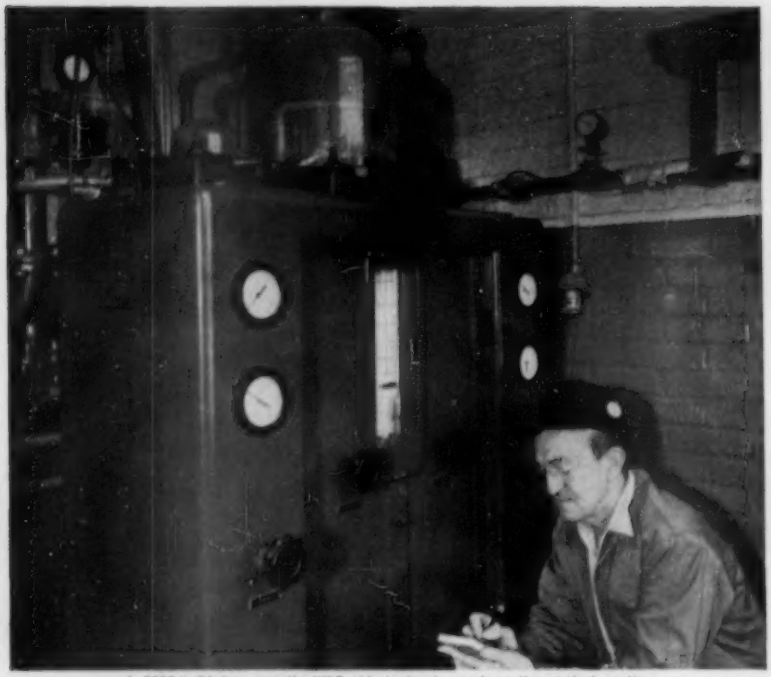

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739 bbl. of oil and 50 bbl. of water in 22½ hours. The flow was through ½-in. choke, under tubing pressure of 180 psi. No. 797 Goldsmith is located in Section 39, Block 44, Township 1 South, T&P Survey.

SOUTHEAST NEW MEXICO

South Four Lakes Extension Well Flows

Humble Oil & Refining Co. 4 South Four Lakes Unit, northwest outpost to South Four Lakes field, Lea County, had flowing oil on a drill-stem test in the Wolfcamp. A 2½-hour test at 9,875-9,907 ft. had gas in 4 minutes and oil in 14. It was flowed into pits for 16 minutes, then turned into tanks where it gaged 124 bbl. of oil in 2 hours through ½-in. choke. Bottom-hole flowing pressure ranged from 1,155-2,925 psi., and shut-in pressure read 4,090 psi. Operators cored ahead after the test. South Four Lakes field produces from the Pennsylvanian and Devonian.

J. Don Hudgins 1 Phillips-State, reworked failure in 8-16s-34e, Lea County, was showing for a Queen sand discovery. Hole was drilled out to 3,970 ft., perforated between 3,950-70 ft., and washed with 500 gal. of mud acid. The well then kicked off and flowed mud and oil. After a second acid treatment it was swabbed for 42 bbl. of new oil in 24 hours. Pumping equipment was being installed for completion.

Shell Oil Co. originally drilled the well to 14,093 ft., in 1955, as a Devonian test.

SOUTH TEXAS

SOUTHWEST TEXAS

Dimmit County Wildcat To Explore Deeper Zones

The Lower Cretaceous-Glen Rose formation is the primary objective of a wildcat test undertaken by a group of San Antonio operators about 5½ miles southeast of Carrizo Springs, in northwestern Dimmit County, in far-southwestern Texas.

Operators include Bowman Cattle, Frank B. Waters, and J. C. McCabe. The test is their 1 Asher Richardson estate, in Section 5, H&GN Survey. Nearest production is in the immediate vicinity of Carrizo Springs.

Chief development and production in the general area has been in the Navarro-Olmos (Upper Cretaceous) sands, varying in depth in the many pools from 1,700 to 4,900 ft. The Glen Rose objective is expected about 9,000 ft.

Oil Production Indicated In Hidalgo County Wildcat

Hargrave Oil Corp. and W. E. Colson, joint operators, have an indicated oil-discovery well 5 miles northwest of Edinburg, in south-central Hidalgo County.

Location, at 2 Max Lutz, is about 2 miles northwest of a lone gas well (Shary field) drilled by L. M. Lockhart in 1952 with production from an 8,200-ft. Frio sand.

The Hargrave-Colson discovery is in a 7,200-ft. sand. An open-hole drill-stem test filled 275 ft. of 47°-gravity oil, plus 10 ft. of oil-cut mud, in 15 minutes. The fill was through ¼-in. chokes, recording pressure of 2,052 psi.

With hole since drilled to 9,000 ft., casing has been run through the pay to 8,360 ft.

SOUTH LOUISIANA

LOUISIANA OFFSHORE

Grand Isle Wildcat Is Dual-Zone Oil Producer

Continental Oil Co., operating for the C.A.T.C. group, has completed a dual-pay oil-discovery well in Block 40, Grand Isle area, 15 miles off the coast of Jefferson Parish, in the Gulf of Mexico.

It is north of the group's prolific, multiple-pay Grand Isle Block 47 field, opened last December.

The new discovery well, 1-A OCS 0128 (State Lease 948), flowed 229 bbl. of 33°-gravity oil per day through 5/32-in. choke from perforations at 9,956-78 ft., and 256 bbl. of 32.6°-gravity oil per day through ⅛-in. choke from perforations at 10,412-22 ft.

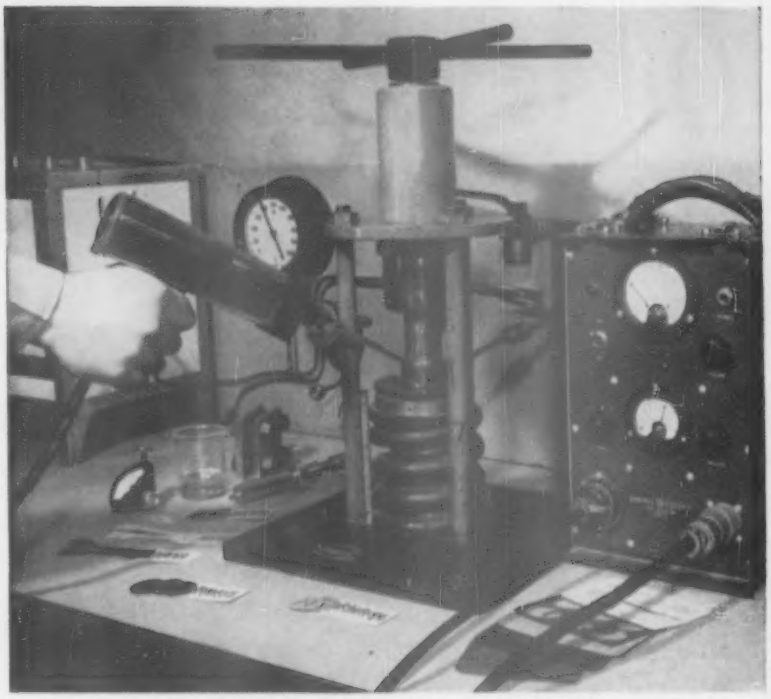
SOUTHEASTERN STATES

MISSISSIPPI

Oil Production Declines In Issaquena Discovery Well

Southeastern Issaquena County's Lower Cretaceous discovery well produced at the rate of 114 bbl. of oil per day during its first 15 hours on the pump, but output since has declined steadily. It was down to 19 bbl. per day, net, with 2 per cent water, at last report.

The well, drilled by Amerada Petroleum Corp., with Don Reese and Vaughey & Vaughey as joint owners, is about 2 miles northeast of Valley Park. It is 20 miles southwest of Tinsley,



This detector is so sensitive it can pick up a leak as small as 1/100 ounce a year.

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nearest field, and 30 miles northwest of Bolton, nearest Lower Cretaceous production.

Completion is in the Mooringsport zone, perforated at 6,264-72 ft. The well was drilled to 7,720 ft. with bottom in the Hosston, topped at 7,506 ft. Showings were encountered in the Rodessa and Sligo zones, but tests failed to get commercial production.

ROCKY MOUNTAIN

UTAH

Gulf Shuts in Indian Discovery

Gulf Oil Corp. 1 Indian, C NE NE 1-41s-22e, San Juan County Pennsylvanian discovery, flowed 143 bbl. of oil in 3 hours on test of perforations at 5,800-10 ft. and 5,768-90 ft.

This discovery, now shut in, is 3½ miles southwest of Recapture Creek in the Aneth trend area of the Paradox basin.

• U. S. Smelting, Refining & Mining Co. 1 Ohio-Navajo, SE NW NW 9-43s-21e, San Juan County, flowed gas at the rate of 5,500 M.c.f. per day on a 45-minute drill-stem test of the Hermosa at 4,842-4,910 ft.

This indicated discovery is 6½ miles northwest of North Boundary Butte in the Paradox basin.

COLORADO

Lyons Discovery Goes On Pump In Weld

The California Co.'s latest Permian-Lyons sand discovery, the 1 Brunner, C SW SW 26-7n-67w, Weld County, is pumping fluid at the rate of 128 bbl. per day, cut 10 per cent water. Production is from perforations in the Lyons sand. This Permian discovery is 4½ miles south of Black Hollow field, the first Lyons producer in the Denver basin. There are three Permian pools in this county, all opened by The California Co.

NORTHWEST NEW MEXICO

Two San Juan Strikes Completed In Gallup

Two Gallup sand discoveries were completed in the San Juan basin last week. Anderson-Prichard Oil Corp. 1 heirs of Ko-Sa, E½ NW SW 23-25n-11w, San Juan County, flowed 300 bbl. of oil and 313 M.c.f. of gas per day on ¾-in. choke from Gallup perforations at 4,972-22 and 4,946-65 ft.

The 1 Be Gay was completed for 3,432 M.c.f. of gas per day from lower Gallup sand perforations at 5,050-58 ft. on ¾-in. choke.

Successful Wildcats

ALBERTA

Christie-Mitchell-Ranchmen's 10-23 Okotoks, LSD 10, 23-20-29w4. TD 9,130 ft. D1 gas well.

Brinkerhoff-H.B. 13-26 Ardrossan, LSD 13, 26-52-22w4. TD 5,105 ft. D2 oil well.

COLORADO

Garfield County: Standard Uranium Corp. 1 Ival E. Young, SE NW 6-8s-102w. IP 18,000 M.c.f. of gas per day, Buckhorn discovery, new field. TD 3,155 ft. Buckhorn.

SOUTHEAST NEW MEXICO

Lea County: John M. Kelly 1 Gulf-Terry, NE NE 14-19s-37e. IPP 11 BOPD, 36°, GOR 300, Penrose pay 4,148 ft. TD 4,400 ft.

WYOMING

Carbon County: Fremont Petroleum 1 Unit, NE NW NE 5-24n-86w. IPF 505 M.c.f. of gas per day, Frontier discovery, new field. TD 5,559 ft. Chugwater.

NORTHWEST NEW MEXICO

San Juan County: Anderson-Phichard Oil Corp. 1 heirs of Ko-Sa, E½ NW SW 23-25n-11w. IPF 300 BOPD, Gallup discovery, new field TD 5,060 ft.

LOUISIANA GULF COAST

Calcasieu Parish: Samedan Oil Corp. 1 West, 16-11s-10w. IP 10,032 M.c.f. daily and 25 BCPD, ¼-in., 49°, perfs. 8,731-36 ft. TD 13,497 ft. Revives Bayou Chopique field.

Plaquemines Parish: Magnolia Petroleum Co. 1-A State Lease 2726, Blk. 46, Main Pass area, Breton Sound. IP 3,440 M.c.f. daily and 251 BCPD, 5/32-in., perfs. 14,291-14,305 ft. TD 16,708 ft. (New offshore field.)

California Co. 2 State Lease 2593, Blk. 83 West Delta area, Gulf of Mexico. IP 389 BOPD, 5/32-in., 33.5°, GOR 712 cu. ft. per barrel, perfs. 10,172-86 ft. TD 11,800 ft. (New offshore field.)

Vermilion Parish: Fifteen Oil Co. 1 Vermilion, 22-14s-4e. Shut-in gas well, no gage, perfs. 11,901-09 ft. TD 13,625 ft. (New field.)

MISSISSIPPI

Issaquena County: Amerada-Reese-Vaughey 1 Delta Wildlife & Forestry, Inc., 5-9n-6w. IPP 114 BOPD, 22°, perfs. 6,264-72 ft. (Mooringsport). TD 7,720 ft. Elev. 100 ft., Paluxy 4,872 ft., Mooringsport 5,858 ft., Hooston 7,506 ft. (New field—Valley Park.)

TEXAS GULF COAST

Bee County: Gust Tsesmelis Oil & Gas Corp. 1A Ida Wood et al, H&GN Sur., A-186. IP 9,000 M.c.f. daily, open-flow potential, GOR 100 M.c.f. per barrel, 50°, perfs. 4,009-16 ft. (Chamberlain). TD 4,088 ft. (New field.)

Gust Tsesmelis et al 2 Ida Wood et al, J. B. Wilson Sur., A-484. IP 30 BOPD, 7/64-in., 29.3, perfs. 4,008-14 ft. TD 4,547 ft. (Oil discovery well in unnamed new field.)

H. C. Hargrove and W. E. Colson 1 Tuttle, J. M. Keeting Sur., A-33. IP 820 M.c.f. daily, open-flow potential, GOR 137 M.c.f. per barrel, 26°, perfs. 4,944-47 ft. TD 5,518 ft. (Extension and new pay in North Blanconia field.)

Nueces County: Arkansas Fuel Oil Co. 1 State Tract 950-S, Gulf of Mexico. IP 15,600 M.c.f. daily, 17 BC per M.M.c.f., 63.5°, perfs. 7,659-74 ft. TD 10,200 ft. (New offshore field.)

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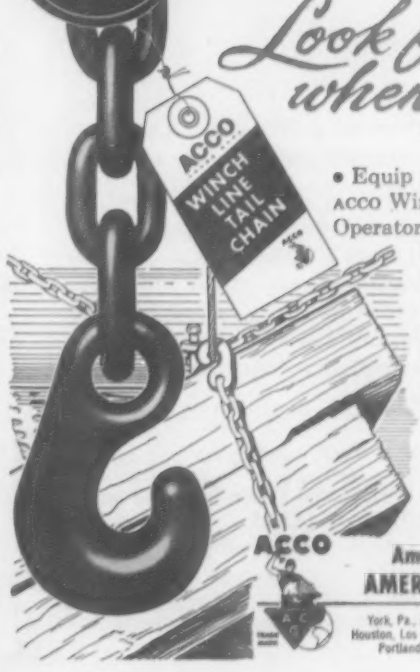

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George H. Paul Subd., Driscoll Ranch. Shut-in gas well, no gage, perfs. 7,191-94 ft. TD 7,228 ft. (Extends Turkey Creek field.)

Victoria County: James C. Freeman 1 Keeran et al, Maritn De Leon Sur. IP 14.16 BOPD, 5/8-in., 31.2°, GOR 16 M.c.f. per barrel, perfs. 5,302-04 ft. TD 5,312 ft. (New field.)

EAST TEXAS

Thos. D. Humphrey & Sons 1 Bishop, W. R. Wilson Sur., A-66, 1 mi. E West Slocum field. IP 134 BOPD, 10/64-in., TP 720 psi., 39°, GOR 772, sub-Clarksville 5,698-5,702 ft. TD 5,904 ft.

NORTH TEXAS

Clay County: L. T. Burns estate 2-D Sanzenbacher, Mund Gross Sur., A-155, 4½ mi. SE Blue Grove. IP 143 BOPD, 10/64-in., TP 400 psi., GOR 693, 43°, pay 6,039-44 ft. TD 6,051 ft.

Knox County: Christie-Stewart 1 Hertel, 13-2-D&W, 4 mi. N Goree. IPP 98 BOPD, 35°, GOR 125, Tannehill sand 1,749-55 ft. TD 1,905 ft.

Christie-Stewart 1 Russell, 100-2-D&W, 1 mi. N Munday. IPP 103 BOPD, 34.8°, GOR 125, perforated 2,017-25 ft. TD 2,131 ft.

Wise County: H. Curtis Plumly Jr. 1 Denny, G. W. Cash Sur., A-66, 3 mi. S Park Springs. IP 102 BOPD, ¾-in., TP 50 psi., 42°, GOR 396, conglomerate 5,653-64 ft. TD 5,866 ft.

WEST TEXAS

Gaines County: Atlantic Refining Co. 8 Riley "D," 283-G-WTRR, 6 mi. NW Seminole. IP 415 BOPD, 24/64-in., TP 155 psi., GOR zero, 27.4°, Wolfcamp 9,076-9,152 ft. TD 11,572 ft., PB 9,152 ft.

Stanolind Oil & Gas Co. 1 Wimberley, 276-G-WTRR, 12 mi. SW Seagraves. IPP 185 BOPD, 42.9°, GOR 45, Strawn 11,-008-32 ft. TD 12,527 ft.

Pecos County: Great Western Drilling Co. 1 Cotten, 10-3-H&TC, 2 mi. E Imperial. McKee pay opener in East Abell field. IP 247 BOPD, 18/64-in., 44°, CP 275 psi., GOR 295, McKee 5,434-40 ft.; IP regular pay, 434 BOPD, 16/64-in., TP 575 psi., GOR 350, 45°, Waddell 5,880-5,914 ft. TD 5,975 ft.

Runnels County: Geochemical Surveys, Inc., et al 1-A Ahrens, Sec. 61, CTRR Sur., 2 mi. SW Hatchel. New pay opener in Ballinger-Gardner field. IPP 73 BOPD, 40°, GOR 200, Home Creek 3,167-71 ft. TD 4,230 ft.

Warren Petroleum Corp. 5 Hord, 72-63-HT&B, 5 mi. W Winters. New pay opener in Fennell (King sand) field. IP 131 BOPD, 16/64-in., TP 80 psi., 44°, GOR 458, Gunsite lime 2,846-51 ft. TD 3,000 ft.

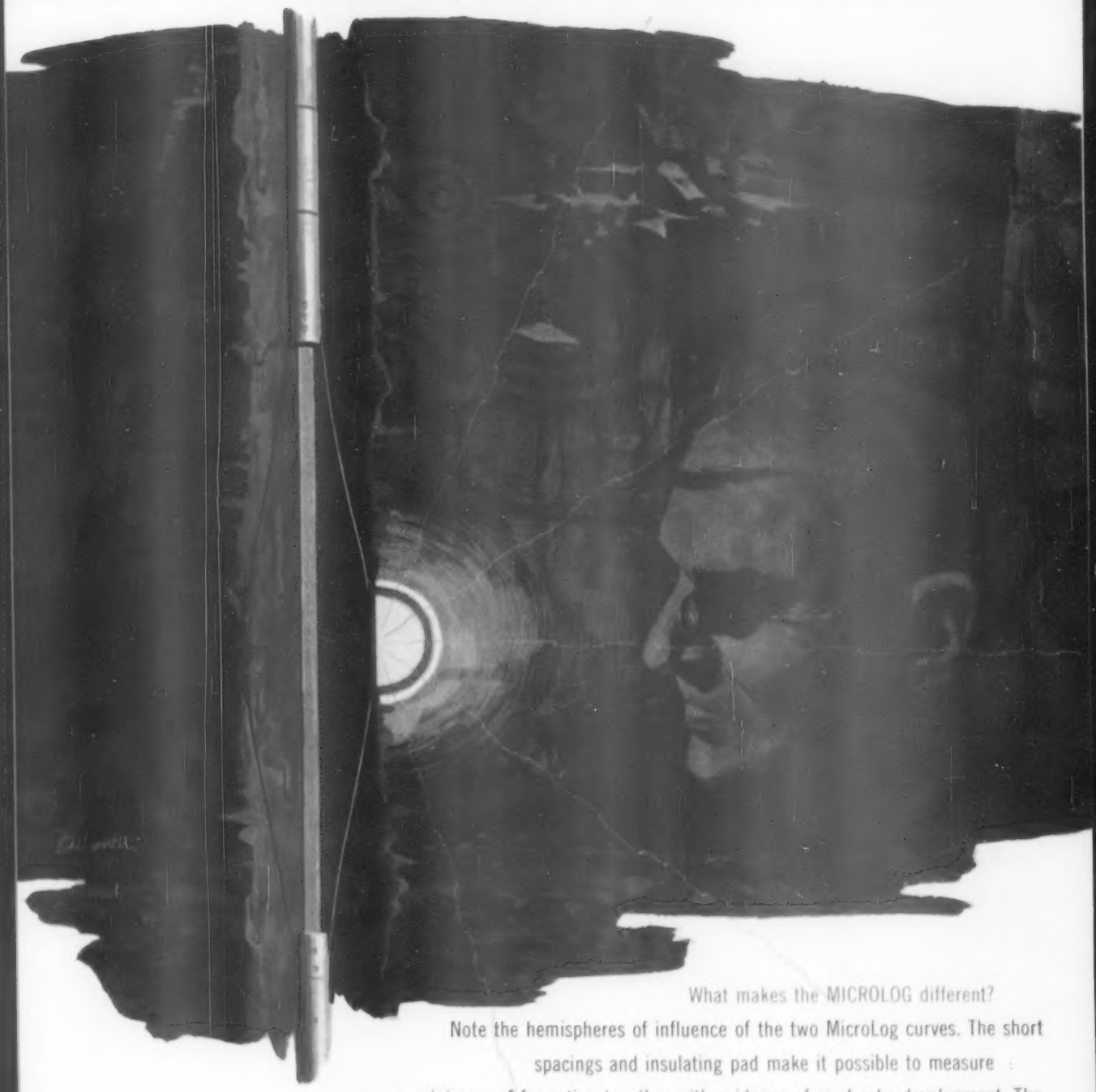
Upton County: Sinclair Oil & Gas Co. 1 Windham, 140-E-CCSD&RGNG, 17 mi. SE Crane. New pay opener in Willrode field. IP 135 BOPD, 20/64-in., TP 110 psi., GOR 900, 35°, perforfated Leonard lime 7,348-48, 7,450-60 ft. Old well recompleted. TD 9,015 ft., PB 7,500 ft.

WEST CENTRAL TEXAS

Fisher County: Ada Oil Co. 1-B Swann, Robert Spires Sur. 283, 6 mi. NE Eskota. IP 246 BOPD, 16/64-in., TP 320 psi., GOR 1272, 42.7°, Canyon reef 4,423-40 ft. TD 4,500 ft.

Jones County: Great Lakes Carbon Corp. 1-A Dickenson, William Harris Sur. 217, 14 mi. SW Anson. IPP 62 BOPD, 39°, GOR 175, Noodle Creek 2,516-22 ft. TD 4,100 ft.

Taylor County: Belcher Trust et al 1 Ramsey Bacon, 30-1-SPRR, 1 mi. W Ovalo. IPP 46 BOPD, 39°, GOR 300, Cross Cut 3,976-87 ft. TD 4,025 ft.



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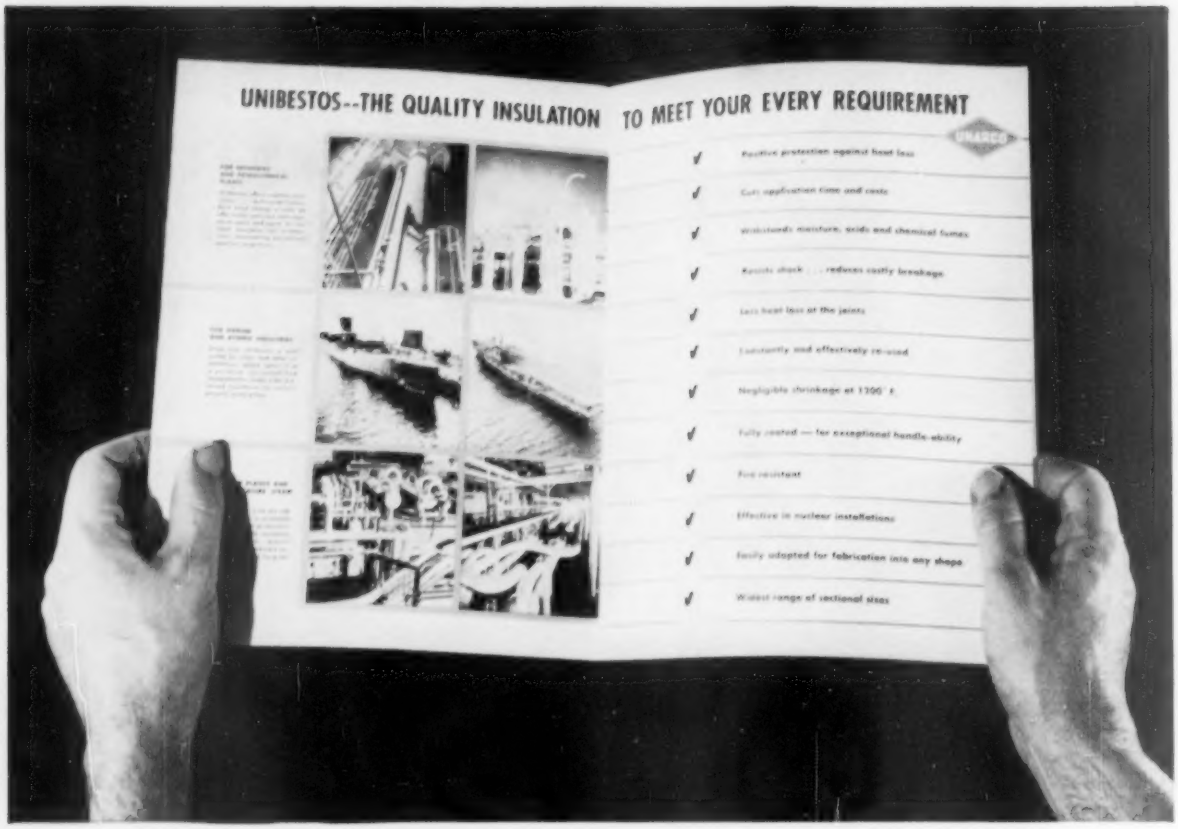

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WHEN Kirby VenSyn Petroleum Co. goes into operation early in 1957 its president will be a young Texan with a career as varied as the company's holdings.

Thirty-seven-year old William Jefferson Montgomery will move from Dallas to Houston when the newly organized company takes over oil properties scattered from Canada to Venezuela. Although the physical move will be a short one, it will represent one of the biggest steps yet taken by a man whose stride has never gone any way but up.

Born in Titus County in East Texas, Jeff Montgomery started in the oil industry as a roustabout at the age of 19. He worked for Tidewater Oil Co. two summers, first at Cayuga field and later at East Texas field, before graduating from Texas A. & M. College.

Top in his class at A. & M., he received his B.S. degree in petroleum engineering there in 1941. After another brief hitch with Tidewater, this time as an associate petroleum engineer, young Montgomery was lured from the oil industry by a scholarship to Harvard Graduate School of Business Administration.

Montgomery studied at Harvard a year before joining the army as a second lieutenant early in World War II. During his 4 years in the Army he rose to major. He was sent to the Mediterranean theater, but one of his toughest assignments was here in the states.

Then in his middle 20's, he was named to the faculty of the Army Command and General Staff School at Fort Leavenworth, Kans. One of the youngest men on the staff, he had the touchy job of trying to teach high-ranking officers how to fight a war.

Discharged from the Army in 1946, Montgomery went back to school—this time to George Washington University where he studied law. He received his L.L.B. in June 1948 and was ranked second in his class.

Return to oil . . . After practicing law at Midland, Tex., from 1948 to 1950, Montgomery returned to the oil industry. He served as general manager of Texas Crude Oil Co. in Fort Worth. Later he became a consulting petroleum engineer there.

During the past 2 years Montgomery has been vice president of the oil and gas division of the C. W. Murchison Interests in Dallas.

Montgomery is married and has four children—two boys and two girls ranging in age from 1 to 9. His wife, Leonora, a former Indiana "Hoosier" and a Wellesley graduate, came to Texas by way of Washington, D. C. She and Montgomery were married there while he was in the Army.

JEFF MONTGOMERY
. . . short move is a big step

Many of the Murchison oil properties are being taken over by the new company, along with some holdings of Venezuelan Syndicate, Inc.; Kirby Oil & Gas Co.; George J. Greer, trustee; and Montex Exploration Co. *(The Oil and Gas Journal, December 3, page 78).*

The newly organized firm, having a net crude-oil production of about 2,000 bbl. per day, will have interests in about 850,000 acres of oil, gas, and mineral leases in the United States and Canada, plus more than 1,200,000 acres in Venezuela. Chairman of the board of the new firm will be George Sawtelle, now president of Kirby Oil & Gas Co.

P. R. Bolenbaker, assistant chief chemist at Shell Chemical Corp.'s Denver plant, has been appointed manager, operations.

G. P. Hinds, chief research chemist at Shell Oil Co.'s Houston refinery, has been appointed chief research technologist. Hinds has been with Shell since 1939. **H. W. Anderson,** chief research chemist at the company's Wood River, Ill., refinery, has been transferred to Houston in the same capacity. **R. A. Burdett,** chief research physicist at Wood River, has been named chief research chemist there.

Personals

Hugh W. Curfman, formerly with Southern Production Co., has joined Christie, Mitchell & Mitchell, Houston, as district geologist in Lafayette, La.

Ernest E. Moore, process engineer for Socony Mobil Oil Co. in Paulsboro, N. J., has joined Esso Research & Engineering Co. in Linden, N. J., as design engineer.

W. B. Davis has been appointed head of the civil engineering group of the general engineering section for Sinclair Oil & Gas Co.'s Tulsa production department. Davis succeeds **H. H. Elliston,** who has retired. Elliston has been with Sinclair since 1936. Davis joined the company in 1942.

Auby Rowe, Jr., district superintendent for McAlester Fuel Co., has been elected president of the Billings, Mont., Petroleum Club. Other officers are **Ward W. Dunn,** first vice president, Phillips Petroleum Co.; **William B. Guyer,** second vice president, independent; and **John T. Jones,** secretary, Mobil Producing Co.

R. R. Dean, vice president of Tennessee Gas Transmission Co., has been promoted to senior vice president in

R. R. DEAN

W. E. SCOTT

charge of manufacturing and marketing. **Wilton E. Scott,** exploration manager, has been elected a vice president. Dean is president of Bay Petroleum Corp., subsidiary of Tennessee Gas.

Mid-Continent Oil and Gas Association has named six veteran oil men to life memberships in the association. They are **Ralph O. Dietler,** retired chairman of the board of Stanolind Oil Purchasing Co.; **C. C. Herndon,** retired executive vice president of Skelly Oil Co.; **J. E. Holm,** retired Oklahoma-Kansas division manager of Atlantic Refining Co.; **Russell Knappen,** retired executive assistant to the vice president of Gulf Oil Corp.; **O. W. Meyers,** head of the federal and state tax division of Sinclair Oil & Gas Co.; and **Arthur F. Truex,** retiring Mid-Continent division manager for Sun Oil Co.

Personals

Joe Lackey of Malco Refining Co., Roswell, N. M., has been elected president of the New Mexico Oil and Gas Association.

W. R. Canada, district geologist for Magnolia Petroleum Co. in Houston, has been promoted to staff geologist in Dallas.

Henry W. Harding, chief engineer for the Mills Bennett estate in Falfurrias, Tex., has joined Nortex Oil & Gas Corp. as chief drilling engineer in Dallas.

John T. McCoy has been appointed chairman of Tidewater Oil Co.'s eastern division supply and distribution committee. McCoy is coordinator in the New York manufacturing department.

Tom Wilson, Ohio Oil Co., has been elected president of the San Joaquin Geological Society. Other officers are **V. L. VanderHoof,** vice president, Index Oil Co., and **Jack Clare,** secretary-treasurer, Superior Oil Co.

Dick T. Fenwick, formerly vice president for operations and production for Southern Production Co., Inc., in Fort Worth, has been transferred to Tulsa as executive assistant in the production department for Sinclair Oil & Gas Co. Sinclair acquired Southern Production last month. Fenwick joined Southern Production in 1941.

Ernest M. Bony has been promoted to senior engineer and transferred to Shell Oil Co.'s Los Angeles office from the Martinez, Calif., refinery. **Fred E. Vidaurri,** engineer with Shell, has been transferred to Los Angeles from Houston.

Lionel W. Wiedey, president and general manager of International Petroleum Co.'s Colombian affiliate from 1946 to 1950, has retired from the company. Wiedey has been coordinator and advisor in the company's Toronto, Canada, and Coral Gables, Fla., offices for the past few years. He joined the company in 1930 in Peru. In 1941 he was named International's chief geologist in Peru and in 1944 became assistant manager of the Colombian affiliate which he later served as president.

E. V. HEWITT

Earl V. Hewitt, former vice president in charge of production of Pan American Production Co., has been named division production superintendent of Stanolind Oil & Gas Co.'s North Texas-New Mexico division at Fort Worth. He succeeds **Charles F. Bedford,** recently transferred to Tulsa as Stanolind's general production superintendent. Hewitt had been with Pan American since 1935, when he joined the company as a field foreman. He became general superintendent of production at Houston in 1938 and was named vice president in 1951. His new position with Stanolind arises from the forthcoming consolidation of the two Standard Oil Co. (Ind.) subsidiaries.

J. D. Perryman has been appointed exploration manager of Tidewater Oil Co.'s central division and transferred from Saskatchewan to Tulsa. Perryman was president of Geotechnical Service Corp., Dallas, before joining Tidewater.

J. V. Evans, assistant director of American Oil Co.'s Baltimore asphalt research laboratory, has been appointed director of research and development at the lab. He succeeds **Merritt C. Hewett,** who has been named assistant manager of asphalt sales for the company.

Daniel S. Johnston, H. J. Stroud, and **James K. Wootan** have been elected directors of Signal Oil & Gas Co. Johnston is assistant manager of the crude oil producing department, Stroud is manager of industrial and public relations, and Wootan, manager of the land and lease department.

Great Basins Petroleum Co. has announced members of its new board of directors. They are **Arthur P. Adkisson,** Long Beach, Calif.; **Dwight C. Baum,** Los Angeles; **H. C. Brown,** Odessa, Tex.; **Thomas W. Evans,** Beverly Hills, Calif.; **Ross J. Ferrar,** Beverly Hills; **C. G. Glasscock, Jr.,** Denver; **R. G. Greene,** Los Angeles; **Irwin R. Harris,** St. Louis; **Clinton LaTourrette,** Los Angeles; **W. E. Morgan,** Denver; **J. R. Pemberton,** Los Angeles; and **Joseph L. Ryons,** Los Angeles. Officers of the company are Evans, chairman of the board; Greene, president; and Morgan, executive vice president. Also, **C. L. Cavness,** Denver, is vice president; **M. H. Goforth,** Denver, secretary-treasurer; and **J. B. Clark,** Denver, is assistant secretary-treasurer.

C. T. Rankin, seismic party chief for Amerada Petroleum Corp., has been transferred to Thermopolis, Wyo., from Evanston, Wyo.

George R. Stocker, former manager of the Bismarck, N. D., branch of Northwest Geological Service, has joined American Metal Co., Ltd., as assistant to the manager of the oil division, New York.

Robert W. Kline, manager of Midwest Oil Corp.'s southern division operations in Fort Worth, has been named vice president in charge of exploration. He replaces **F. M. Ricks,** who recently resigned.

Jim McCourt, district geologist for Union Oil Co. in Durango, Colo., has been transferred to Denver as senior geologist. **Earl Turner** has been transferred to Durango from Salt Lake City to replace McCourt.

R. C. Brown, president of Hudson's Bay Oil & Gas Co., Ltd., has been elected chairman of the Canadian Petroleum Association board of governors. Brown succeeds **G. L. Knox,** president of California Standard Co.

T. E. Weirich, chief subsurface geologist in Phillips Petroleum Co.'s land and geological department, has been appointed assistant manager of the department's Osage County, Oklahoma, area. **Renato Passega,** exploration research geologist will replace Weirich as chief subsurface geologist.

R. M. KENNEDY

Robert M. Kennedy, manager of Sun Oil Co.'s basic research division, has been named associate director of the research and development department. Kennedy joined Sun as research scientist in 1941. **Abraham Schneider,** section chief in the fuels division, will succeed Kennedy in the basic research division. Schneider has been with Sun since 1945.

R. O. Wilson, manager of Cosden Petroleum Corp.'s asphalt division, has been elected chairman of the board of the Asphalt Institute. He succeeds **Sidney Goldin** of Shell Oil Co. Five new regional vice presidents have also been named by the Institute. They are **T. F. McCarey,** Cities Service Oil Co.; **D. H. Jenks, Jr.,** Ashland Oil & Refining Co.; **G. L. Farnsworth,** Husky Oil Co.; **Wayne Barbour,** Allied Materials Corp.; and **C. V. Kiefer,** Shell Oil Co.

Max Mott, staff geologist with Union Oil Co. in Denver, has resigned to open geological consulting offices there.

A. J. WOOD

A. J. Wood, chief technologist at Shell Oil Co.'s Wood River, Ill., refinery, has been named superintendent of operations at the company's Houston refinery. He succeeds **J. L. Miller,** new manager of the Montreal refinery of Shell Oil Co. of Canada, Ltd. Wood has been with Shell since 1938. **J. W. Sheehan,** senior technologist in the head office manufacturing technological department, will succeed Wood at Wood River.

John J. Knebles, Jr., district geologist for Signal Oil & Gas Co. in Abilene, Tex., will transfer to Calgary January 1 to open a Canadian exploration office for the company. He will handle exploration for Manitoba, Saskatchewan, Alberta, British Columbia, and the Northwest Territories.

Raimundo J. Galletti has been named chief of the commission in the United States of the Argentine company, Yacimientos Petroliferos Fiscales (Y.P.F.). He succeeds **Roberto M. Giannattasio,** who has returned to Buenos Aires to continue in the executive management ot Y.P.F.

L. A. Bell, district production superintendent for Sinclair Oil & Gas Co. in Oklahoma City, has been promoted to assistant division production superintendent with headquarters in Tulsa. Bell has been with Sinclair since 1920. He succeeds the late K. E. Thornton. **O. G. Simpson,** district superintendent in the company's Nowata, Okla. production department, will replace Bell in Oklahoma City, and **C. E. Most,** assistant district superintendent, will succeed Simpson as district superintendent at Nowata.

Raoul Bethancourt, Sun Oil Co. petroleum engineer, has been named 1957 chairman of the Dallas section of the American Institute of Mining, Metallurgical, and Petroleum Engineers, replacing outgoing chairman **John Arps,** vice president of British-American Oil Producing Co. New vice presidents of the group are **Allen Gibson,** Magnolia Petroleum Co., and **Norman Clark,** Core Laboratories, Inc. Other officers are **Joe Gordon,** treasurer, Three States Natural Gas Co.; and **Fred Oliver,** secretary-treasurer, DeGolyer & MacNaughton.

N. C. Kymes, field superintendent of the Milfay, Okla., plant of Kerr-McGee Oil Industries, Inc., has been appointed superintendent of the company's Fittstown, Okla., natural-gasoline plant. He succeeds **Fred Fox,** who has resigned. **Kenneth Smith** will replace Kymes in Milfay.

Leon B. Dorsey, superintendent of plants for Southern Production Co. in Fort Worth, has been transferred to Tulsa as assistant superintendent of operations-gas in the gas production department for Sinclair Oil & Gas Co. Sinclair acquired Southern Production November 1.

A. S. (Steve) Gilliam has been appointed plant manager of the Pine Bend, Minn., refinery of Great Northern Oil Co. Gilliam was formerly project manager and assistant plant manager for Olin Mathieson Chemical Corp. in Morgantown, W. Va. He was also with Shell Oil Co. at one time.

William P. Von Osinski has resigned as Ada Oil Co. district geologist at Midland, Tex., to become chief geologist for Hamilton Brothers, Midland, in charge of exploration activities in Kansas, Colorado, Oklahoma, New Mexico, and Texas.

Alexander Johnston, chairman of the board of Sinclair Crude Oil Co., Tulsa, will retire January 1. Johnston has been chairman of the company since it was started in 1953. He was vice president in charge of crude marketing division for Sinclair Oil & Gas Co. before the separate company was formed to handle crude purchases and sales.

A. E. Crouse, Continental Oil Co.'s southwestern region superintendent of natural gas and gasoline operations in Fort Worth, has been named coordinator of plant operations in the company's headquarters production department, Houston. **F. B. Willson,** southern region superintendent of natural gas and gasoline operations in Houston, has been promoted to coordinator of natural gas sales.

Wilbur Rocchio has been promoted from vice president to executive vice president of McRae Oil & Gas Corp. and president of Roden & McRae Drilling Corp., both of Midland, Tex. As president of the latter firm, Rocchio succeeds **James A. McRae,** who has moved up to chairman of the board. The executive vice presidency of McRae Oil & Gas is a newly created position. **A. N. Brown,** manager of McRae's land department, has been elected a vice president of the company.

Personals

K. S. Fricke, senior development geologist for Richmond Exploration Co., Venezuelan operating subsidiary of Standard Oil Co. of California, has been appointed chief development geologist. He replaces **E. R. Critchett,** who has transferred to American Overseas Petroleum Co., New York.

Herschel M. Martin, Jr., former assistant general manager of Eastern States Petroleum Co., Inc., refineries, has been promoted to general manager of refineries. A graduate of Texas A. & M., Martin joined Eastern States as a part-time employe in 1939 while he was still in school.

A. J. Manulik has been promoted by Monterey Oil Co. to district geologist for the firm's West Texas-New Mexico district at Midland, Tex., succeeding **Howard E. Davis, Jr.,** who resigned recently to become an independent operator.

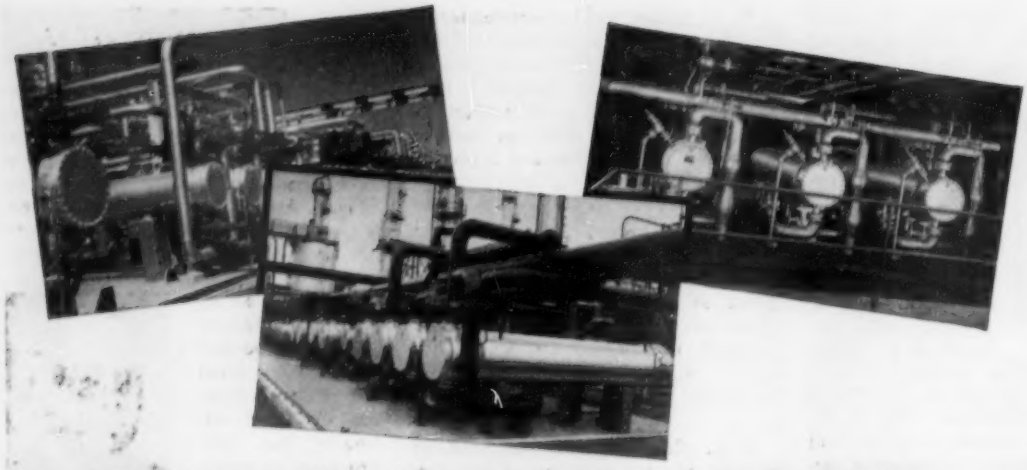
DEATHS

Anthony Folger, Dallas, vice president and senior geologist with DeGolyer & MacNaughton, was a passenger on the Canadian Air Lines transport which was reported missing December 10. He was en route to Calgary. Folger had been with DeGolyer & MacNaughton since 1947. He was previously a consultant in Wichita and before that was with Northern Ordnance Co. and Gulf Oil Corp.

William C. O'Ferrall, 74, Louisiana and Arkansas independent, died December 5 in Shreveport, La. O'Ferrall entered the oil business around 1919. He was president of the O'Ferrall Production Co., owner of Louisiana Wells Servicing Co. and Tanner & Co., Inc. He also was a director of the Louisiana-Arkansas division of Mid-Continent Oil and Gas Association at one time.

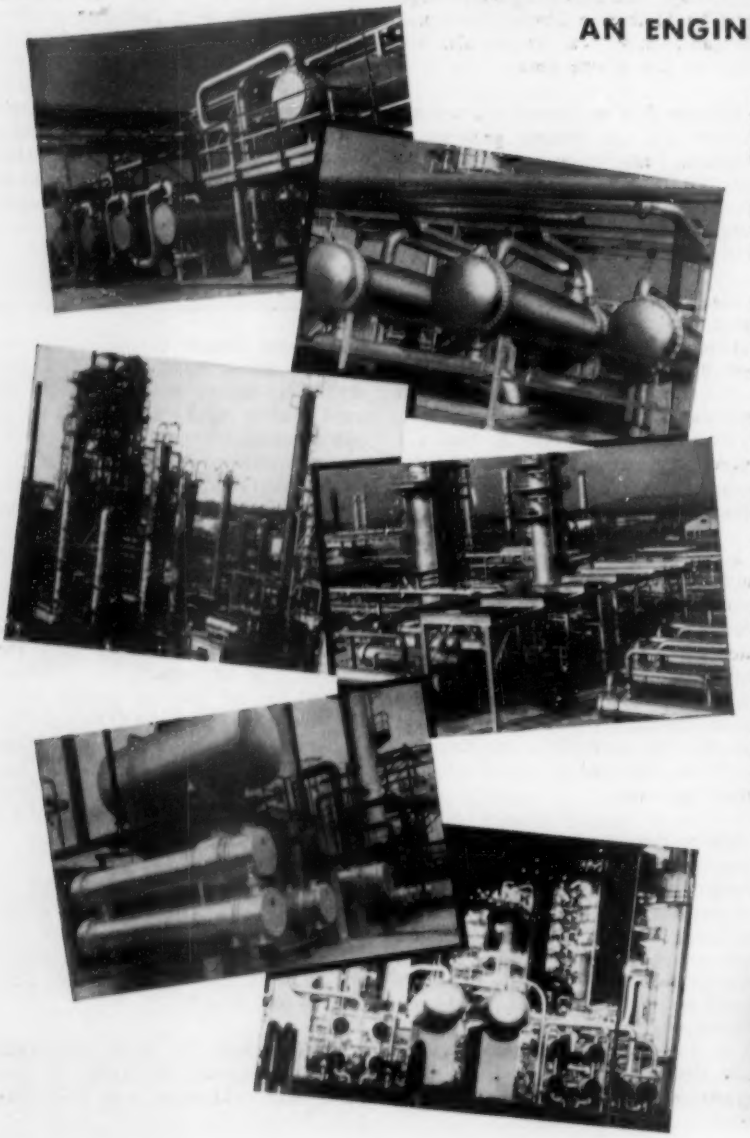
J. S. (Jack) Allen, 60, manager of Pure Oil Co.'s Port Allen terminal, died December 5 at Baton Rouge, La. Allen was manager of the company's Smiths Bluff refinery, Nederland, Tex., after World War II.

H. C. Nelson, 74, North Muskegon, Mich., a pioneer Michigan oil producer and wildcatter, died December 5 in Miami, Fla.



what heat transfer characteristics are needed here...and why?

AN ENGINEERED ANSWER FOR YOU



In substance, and in nearly every instance, that's the question that's put to Ross.

It can apply to chemical processing, petroleum refining, power generation or nuclear energy... wherever specialized heat exchangers are indicated.

It may call for a highly complex design, high temperature or high pressure construction, special materials... a single unit or dozens of identical ones.

The point is that whatever the requirements, Ross will present you with a thoroughly considered, engineered answer. No one is more qualified to give it. No one is better equipped to deliver the finished product.

When you come to Ross for the engineering solution, of this you can be certain: your questions or those of your consultants will be answered with well qualified "reasons why," based upon vast experience in the specially engineered shell and tube heat exchanger field. Your inquiry will bring a nearby Ross representative promptly to your desk.

Ross Heat Exchanger Division of American-Standard, Buffalo 5, N.Y. In Canada: American-Standard Products (Canada) Limited, Toronto 5, Ont.

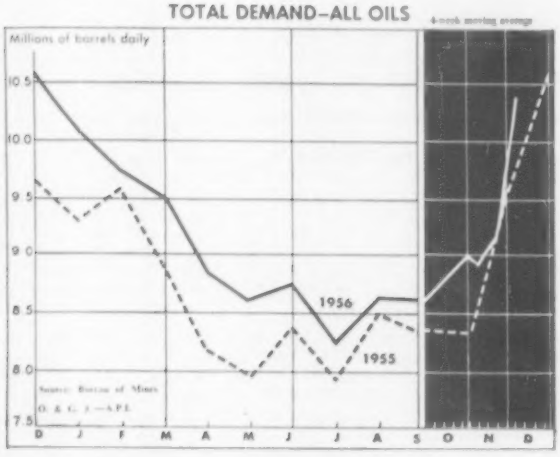
ROSS

ROSS HEAT EXCHANGER PRODUCTS

Latest Figures . . . Industry Trends

A QUICK LOOK AT THE HIGHLIGHTS

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	7,272,450	UP	168,800	UP	156,363
Crude stocks	275,253,000	DOWN	4,589,000	DOWN	2,440,000
Completions	1,025	UP	12	DOWN	200
Refinery runs	7,865,000	DOWN	249,000	UP	247,000
Gasoline stocks	175,427,000	UP	26,000	UP	17,053,000
Kerosine stocks	33,111,000	DOWN	1,484,000	UP	1,106,000
Distillate stocks	145,550,000	DOWN	7,948,000	UP	11,137,000
Residual stocks	43,468,000	DOWN	921,000	UP	701,000
Four-product stocks	397,556,000	DOWN	10,327,000	UP	29,997,000
Total imports	1,684,400	UP	290,400	UP	217,000



Suez Canal Closing Has Created Problems in Estimating Demand

FOR the next few months, total demand figures, calculated from weekly reports, will have higher percentages of estimates than normal. To a certain extent, weekly errors will tend to be compensating in the 4-week moving averages.

Total demand for the four major products can be calculated from refinery production of these products plus imports or transfers with credit given for either increases or decreases in stocks. Since there are no current weekly figures for the minor products, demand must be estimated from seasonal changes and annual trends. In normal times, these estimates can be made with only a small percentage error.

Without the Suez problem, total demand for other products and crude during the month of December would be about 1,575,000 bbl. daily. But, since the closing of the Suez Canal, oil movements have been anything but normal. Most of the difficulty comes when the estimator tries to make a good weekly breakdown of crude movement. The destination of the crude determines the effect on total demand.

. . . If the crude moves to Europe to replace Middle East crude, lost through the closing of the canal, the total is added to this country's total demand.

. . . If the crude moves to the East Coast to replace Middle East crude, it does not raise total demand, but it does increase demand for domestic crude.

. . . If crude from South America that normally moves to our East Coast is replaced by crude from our Gulf Coast, there is no gain in total demand. If the same switch takes place in the supply for East Canadian refineries, our total demand will increase.

. . . Shipments of major products to Europe or eastern Canada are a part of total demand, but any change in these movements will be accounted for in the weekly reports of inventories.

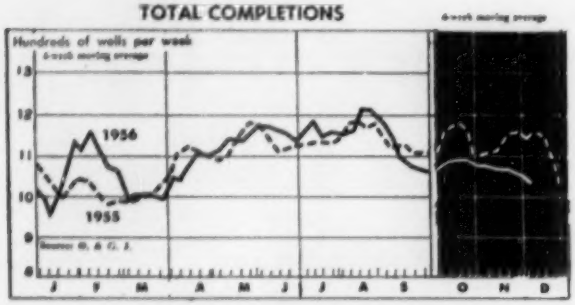
. . . Indicated exports of crude, calculated from production, stocks, and refinery runs, will vary too much on a week to week basis to be of much value in estimating total demand.

Demand in December for other products and crude is now estimated at about 1,950,000 bbl. daily. This total plus demand for the four major products will be used as total demand for the chart on this page. Current reports from Washington indicate that the crude export movement will be greater in the last half of the month than for the first part. Weekly figures for other products and crude will increase from a little over 1,900,000 bbl. daily for the first week to a little over 1,975,000 bbl. daily for the last full week of December. If current information on crude shipments shows larger gains, the adjustment will be raised.

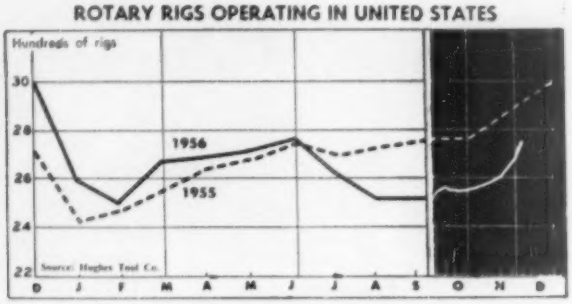
The Bureau of Mines' estimated demand for domestic crude in December at 7,725,000 bbl. daily, up almost 700,000 bbl. daily from the total forecast for November. Part of this increase may go to higher refinery runs. December refinery runs have been higher than November for every year but two since the war. December runs were up 87,000 bbl. daily last year.

Also, at least 300,000 bbl. daily of the increase will replace Middle East crude on the East coast. Crude exports could be up 300,000 to 400,000 bbl. daily.

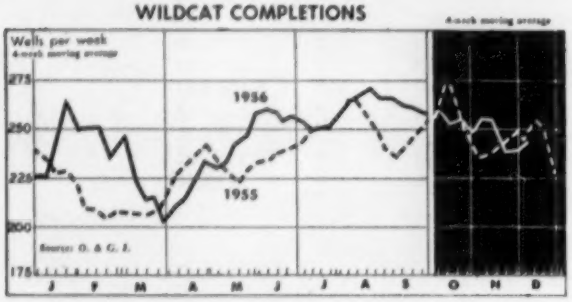
TOTAL COMPLETIONS



ROTARY RIGS OPERATING IN UNITED STATES



WILDCAT COMPLETIONS



ACTIVE ROTARY RIGS*

Area—	12-10-56	12-3-56	12-12-55
North Central and East	119	101	144
Southeast	39	41	37
Okla., Kans., Ark., Mo.	489	480	588
Louisiana	484	478	438
North and East Texas-Panhandle	463	437	448
Gulf and South Texas	280	264	281
West Texas-New Mexico	522	513	639
Rocky Mountain	256	243	301
Pacific Coast	114	117	152
Total United States	2,766	2,674	3,028
Western Canada	241	231	190

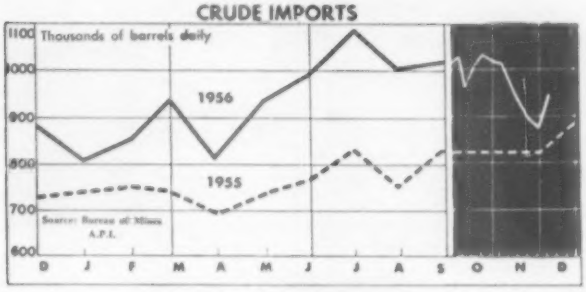
*Hughes Tool Co.

WEEKLY WELL COMPLETIONS . . . WEEK ENDED DECEMBER 8, 1956

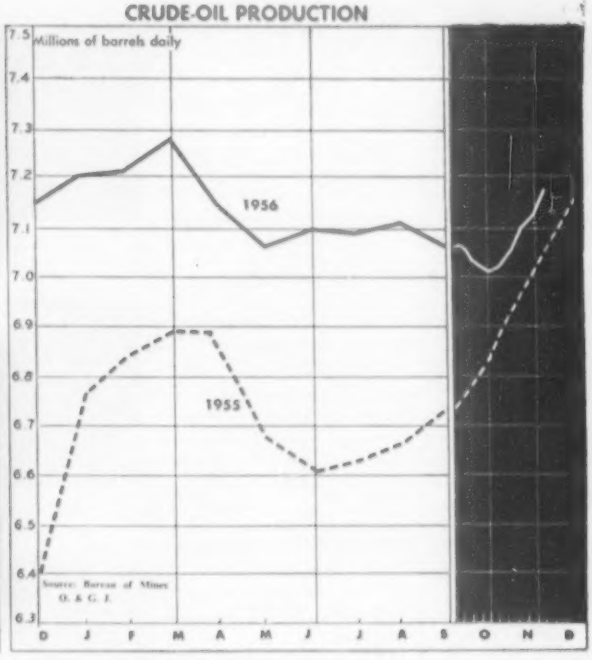
	Total of all wells					Cum.		Wildcat completions and discoveries					Cumulative total, 1956				
	Comp.	Oil	Gas	Dry	Footage	1956	1955	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
Ala.-Ga.-Fla.	3	1	0	2	22,060	106	69	0	0	0	2	2	0	0	1	48	49
Arkansas	20	10	0	10	54,156	908	779	0	0	0	4	4	32	0	7	135	174
California	43	32	0	11	161,867	2,103	2,299	0	0	0	6	6	47	0	9	431	487
Colorado	41	7	5	29	188,959	1,147	1,415	2	0	1	22	25	26	0	18	583	627
Illinois	76	24	2	50	157,563	3,627	3,682	1	0	1	30	32	49	0	5	686	740
Indiana	11	5	0	6	22,784	674	685	0	0	0	1	1	16	0	1	116	133
Kansas	106	63	4	39	376,093	4,650	4,747	5	0	0	15	20	119	4	40	845	1,008
Kentucky	24	6	2	16	42,141	1,793	1,523	0	0	0	8	8	39	0	0	372	411
Louisiana	77	47	9	21	510,672	3,565	3,815	1	0	3	7	11	111	49	59	499	718
North	41	28	2	11	129,013	1,580	1,983	0	0	0	3	3	32	2	3	207	244
South	27	15	6	6	289,485	1,592	1,832	0	0	2	3	5	63	41	41	256	401
Offshore	9	4	1	4	92,174	393	.....	1	0	1	1	3	16	6	15	36	73
Michigan	9	3	0	6	28,477	408	497	0	0	0	5	5	9	0	2	145	156
Mississippi	4	2	0	2	33,975	407	433	1	0	0	0	1	18	1	1	181	201
Montana	11	5	0	6	71,208	441	377	0	0	0	5	5	11	0	1	158	170
Nebraska	14	2	0	12	87,316	877	837	1	0	0	7	8	38	0	1	395	434
New Mexico	36	19	9	8	140,671	1,802	1,604	1	0	0	6	7	52	1	9	201	263
Northwest	17	2	9	6	47,214	801	561	0	0	0	5	5	13	0	7	78	98
Southeast	19	17	0	2	93,457	1,001	1,043	1	0	0	1	2	39	1	2	123	165
North Dakota	8	6	0	2	67,756	253	244	0	0	0	0	0	8	0	0	66	74
Ohio	0	0	0	0	0	997	1,146	0	0	0	0	0	2	0	4	6	12
Oklahoma	109	55	9	45	406,206	7,654	8,076	3	1	3	9	16	121	20	38	635	814
Pennsylvania-New York	19	0	8	11	92,821	1,061	1,405	0	0	1	4	5	0	0	15	21	36
Texas	372	209	18	145	1,550,095	20,338	19,089	12	0	7	100	119	699	32	189	4,355	5,275
Southwest (1 & 4)	48	11	8	29	206,841	2,902	2,941	0	0	3	18	21	121	6	65	830	1,022
Gulf Coast (2 & 3)	53	21	4	28	341,479	2,483	2,382	3	0	2	20	25	63	16	72	670	821
East (5 & 6)	14	5	2	7	65,179	1,067	944	0	0	1	6	7	15	3	7	376	401
N. Central (7-B & 9)	141	83	0	58	413,375	7,261	7,125	8	0	0	40	48	312	0	12	1,735	2,059
West (7-C & 8)	93	72	1	20	431,695	5,382	4,698	1	0	1	15	17	169	0	12	673	854
Panhandle (10)	23	17	3	3	91,526	1,243	999	0	0	0	1	1	19	7	21	71	118
Utah	3	1	1	1	19,255	133	81	0	0	0	1	1	1	0	5	66	72
West Virginia	13	3	7	3	39,561	655	614	0	0	0	1	1	0	0	14	11	25
Wyoming	26	11	0	15	92,001	855	850	0	0	0	7	7	17	0	11	232	260
Miscellaneous	0	0	0	0	0	71	58	0	0	0	0	0	4	0	0	60	64
Total U. S.	1,025	511	74	440	4,165,637	54,525	54,325	27	1	16	240	284	1,419	107	430	10,247	12,203
Total previous week	1,013	530	70	413	3,933,201	.....	.....	20	2	7	216	245	1,402	106	414	10,007	11,929
Total Dec. 10, 1955	1,225	651	70	504	4,567,220	.....	.....	23	9	7	249	288	1,530	211	324	9,599	11,664
Cumulative 1956	54,525	29,330	3,859	21,336	218,917,096	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Western Canada	63	43	6	14	260,085	3,054	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

Service wells included: 17.

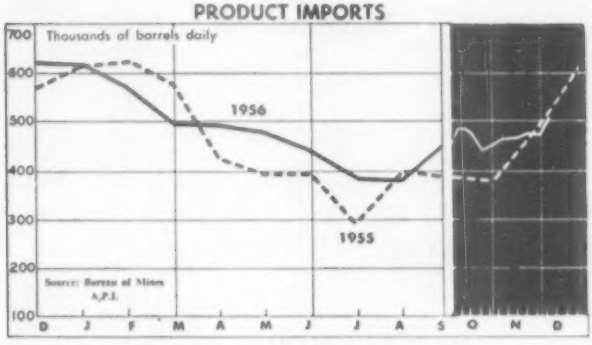
CRUDE IMPORTS



CRUDE-OIL PRODUCTION



PRODUCT IMPORTS



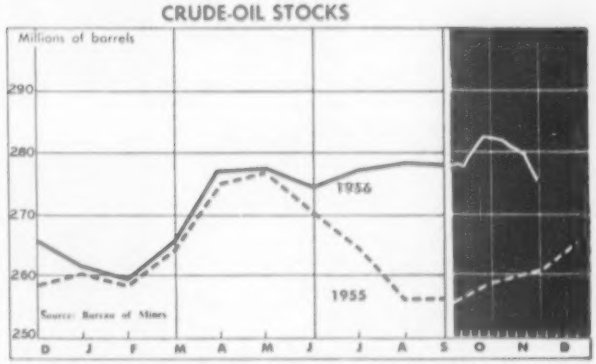
DAILY AVERAGE PRODUCTION FOR WEEK

	December 8, 1956			Dec. 1
	Crude oil	Lease condensate	Total	total
Alabama	11,250		11,250	11,200
Arkansas	79,000	325	79,325	78,250
California	950,800		950,800	951,800
Colorado	†57,700		157,700	158,400
Eastern	49,000		49,000	49,800
Florida	1,300		1,300	1,275
Illinois	234,600		234,600	232,900
Indiana	31,600		31,600	31,700
Kansas	†335,700		†335,700	†327,500
Kentucky	45,200		45,200	45,800
Louisiana	819,700	77,700	897,400	843,650
North	128,700	2,700	131,400	131,000
South	691,000	75,000	766,000	712,650
Michigan	28,400		28,400	28,200
Mississippi	109,275	5,000	114,275	113,950
Montana	66,000		66,000	60,400
Nebraska	37,900		37,900	39,100
Nevada	200		200	200
New Mexico	242,000	4,350	246,350	§245,425
North Dakota	32,550		32,550	37,200
Oklahoma	†601,500		†601,500	†546,600
Texas	3,002,000	55,900	3,057,900	3,006,100
Dist. 1	55,500	575	56,075	57,550
Dist. 2	144,600	8,700	153,300	153,600
Dist. 3	430,500	26,000	456,500	443,000
Dist. 4	230,000	6,800	236,800	232,500
Dist. 5	39,500	550	40,050	39,450
Dist. 6	127,000	6,300	133,300	130,000
East Texas field	207,900		207,900	202,600
Dist. 7-B	159,000	60	159,060	155,045
Dist. 7-C	166,000	4,500	170,500	175,905
Dist. 8	1,128,000	1,500	1,129,500	1,100,600
Dist. 9	208,000	690	208,690	210,650
Dist. 10	106,000	225	106,225	105,200
Utah	8,700		8,700	8,600
Wyoming	284,700		284,700	285,500
Others	‡100		‡100	‡100
Total U. S.	7,129,175	143,275	7,272,450	§7,103,650
Change from prev. week, up			168,800	
Canada	†475,800		†475,800	†509,200

Total U. S. production—January 1-December 8 ..... 2,447,576,950 bbl.
Same period last year (crude plus cond.) ..... *2,320,210,990 bbl.

*Includes 38,720,350 bbl. condensate. †Week ended previous Monday. ‡South Dakota. §Revised.

CRUDE-OIL STOCKS

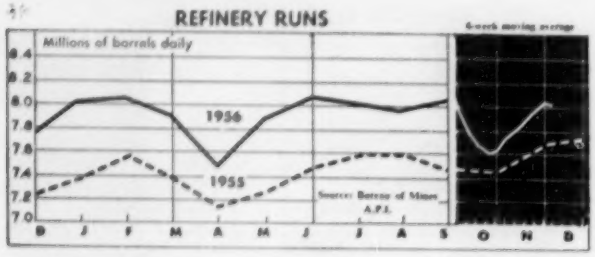


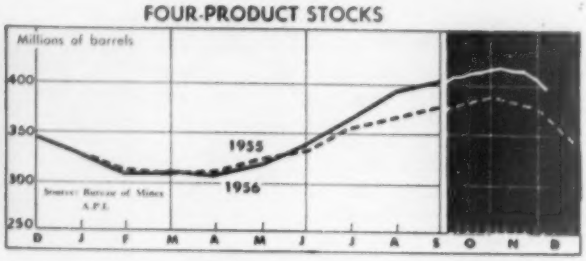
CRUDE-OIL STOCKS BY STATES OF ORIGIN*

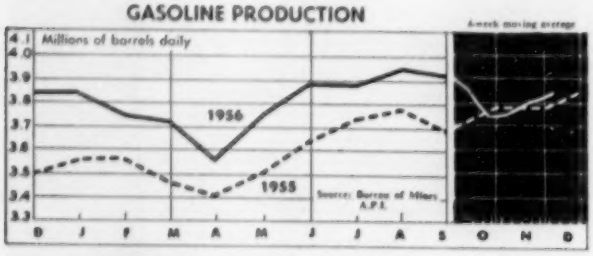
(Thousands of barrels)

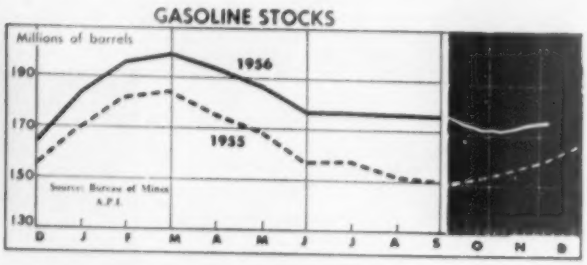
	12-1-56	11-24-56	12-3-55
Pennsylvania Grade	2,358	2,436	2,991
Other Appalachian	2,254	2,384	2,117
Illinois, Indiana, Michigan	11,405	11,760	9,808
Nebraska, North Dakota	2,128	2,347	2,154
Kansas	10,711	10,756	7,662
Oklahoma	23,974	23,830	21,426
Arkansas	2,801	2,985	2,418
Louisiana	17,442	18,312	16,797
North	2,561	2,540	3,052
South	14,881	15,772	13,745
Mississippi	3,272	3,197	2,685
New Mexico	7,933	8,373	7,447
Texas	124,881	127,299	122,053
East Texas proper	8,663	9,009	9,549
West Texas	59,363	61,339	56,284
Texas Gulf	24,370	24,253	25,367
Other Texas	32,485	32,698	30,853
Wyoming	16,944	16,864	15,007
Other Rocky Mountain	6,386	6,555	5,823
California	29,357	29,016	26,901
Foreign	†13,407	13,728	12,404
Total	275,253	279,842	257,693

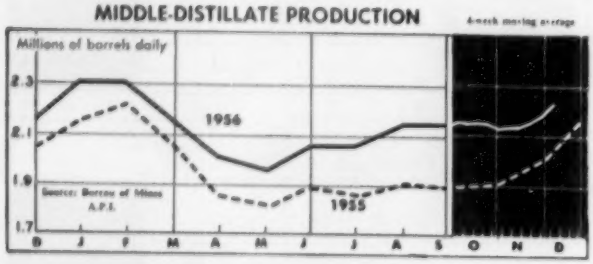
*Bureau of Mines. †Includes 3,302,000 bbl. in California.

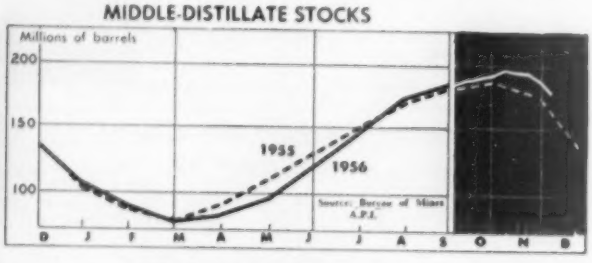


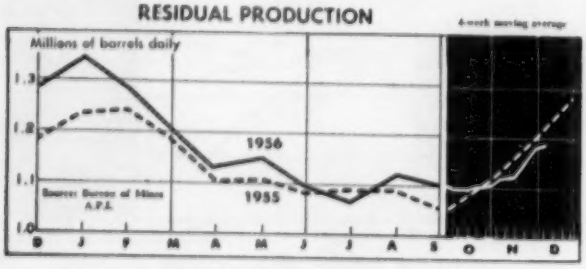


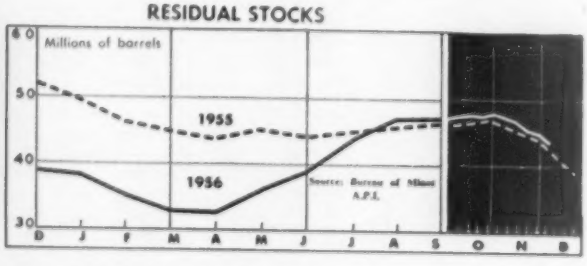

GASOLINE PRODUCTION
Millions of barrels daily
4-week moving average
1956
1955
Source: Bureau of Mines A.P.I.
D J F M A M J J A S O N D




MIDDLE-DISTILLATE PRODUCTION
Millions of barrels daily
4-week moving average
1956
1955
Source: Bureau of Mines A.P.I.
D J F M A M J J A S O N D




RESIDUAL PRODUCTION
Millions of barrels daily
4-week moving average
1956
1955
Source: Bureau of Mines A.P.I.
D J F M A M J J A S O N D



A.P.I. REFINERY REPORT, DECEMBER 7, 1956

(Thousands of barrels)

District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks‡ Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, December 1955 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	1,102	483.1	44.3	311.3	221.0	39,840	12,719	55,243	10,908	1,095	460.9	27.1	287.8	257.8
Appalachian:														
District 1	107	42.9	4.3	27.7	13.6	4,712	599	3,305	343	107	45.0	6.1	23.7	8.0
District 2	91	59.9	3.4	16.7	15.9	2,855	644	1,069	249	105	55.4	8.8	17.8	14.4
Ind., Ill., Ky.	1,422	760.7	94.4	311.6	211.3	29,726	7,297	22,681	5,761	1,472	773.1	84.6	311.0	226.1
Minn., Wis., Dak.	101	49.6	4.3	29.6	6.1	7,234	1,653	8,123	105	(§)	(§)	(§)	(§)	(§)
Okla., Kans., Mo.	670	376.1	6.0	183.3	38.8	14,841	1,720	13,499	1,447	717	417.7	18.4	188.9	41.3
Inland Texas	271	201.1	10.4	50.3	12.9	7,066	548	1,981	1,786	260	191.6	12.2	48.3	27.0
Texas Gulf Coast	1,865	864.9	129.7	489.1	241.3	24,964	3,487	14,102	6,049	1,906	895.1	146.3	478.0	256.6
La. Gulf Coast	709	370.6	90.3	175.7	63.1	11,735	2,643	6,777	1,499	694	350.1	67.1	149.1	46.6
N. La. and Ark.	103	38.0	8.7	20.4	6.9	4,619	988	2,219	287	94	37.0	8.5	23.1	7.0
Rocky Mountain:														
New Mexico	28	14.7	0.6	5.3	4.3	510	12	127	68	24	12.3	0.5	4.0	3.0
Other Rocky Mtn.	248	130.4	12.1	50.7	34.0	5,256	454	2,819	925	253	124.3	4.7	60.9	40.9
West Coast	1,148	499.0	3.6	213.7	325.1	22,069	347	13,605	14,041	1,035	483.6	10.5	172.2	357.7
Dec. 7, 1956	7,865	3,891.0	412.1	1,885.4	1,194.3	175,427	33,111	145,550	43,468	7,762	3,846.1	394.8	1,764.8	1,286.4
Nov. 30, 1956	8,114	3,863.3	340.9	1,968.4	1,223.9	175,401	34,595	153,498	44,389	.....	.....	.....	.....	.....
Dec. 9, 1955	7,618	3,792.3	348.1	1,694.7	1,216.9	158,374	32,005	134,413	42,767	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines. §Included in Indiana, Illinois, Kentucky district.

Crude-Oil and Refinery Prices at Representative U. S. and Foreign Points

REFINED-PRODUCT PRICES

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):	
Regular (88 octane)	10.75-11.50
Premium (96 octane)	12.50-13.25
Gulf Coast (cargoes for coastwise or export movements):	
Regular (90 octane)	11.00-11.50
Regular (92 octane)	11.25-11.75
Premium (97 octane)	12.75-13.25
Premium (98 octane)	13.00-13.50
California (rack):	
Regular (84 octane)	12.35-12.6
Premium (93 octane)	13.4-13.6
Premium (96 octane)	14.6
Caribbean area (cargoes):	
Regular (87 octane)	10.00
Premium (93 octane)	11.50

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

NATURAL GASOLINE*

Group 3:	
Grade 26-70	4.5
Breckenridge:	
Grade 26-70	4.0

*If 26-70 natural is considered as 100 per cent, prices for lower-vapor-pressure grades increase 2.5 per cent for each unit drop in Reid vapor pressure down to and including 16-lb. Prices for grades below 16-lb. may vary slightly by areas or plants.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):	
Kerosine 42-44	9.875-10.00
Diesel oil (58 d.i. and above)	9.50-9.75
Distillate No. 1	9.50-9.75
Distillate No. 2	8.875-9.00
Gulf Coast (cargoes):	
Kerosine 41-43	9.75-10.25
Distillate No. 2	9.25-9.75
New York Harbor (barges):	
Kerosine 41-43	11.25
Distillate No. 2	10.65
Diesel fuel, 48-52 d.i.	10.95
Caribbean area (cargoes):	
Distillate No. 2	9.25

WAX (LB.)

Oklahoma (Group 3):	
132-135 A.m.p. (semi-refined) in tank cars	6.50
New York (export):	
126-130 A.m.p. crude scale (solid in bags or barrels)	7.35

★Denotes change from previous week.

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):	
Residual fuel (max. 1% S)	$2.30-2.50
Gulf Coast (cargoes):	
Bunker C fuel	$2.35-2.60
New York Harbor (barges):	
Bunker C fuel	$3.05
Caribbean (cargoes):	
Bunker C	$2.35
California (rack):	
Bunker C fuel, Los Angeles	$2.50

LUBRICATING OILS

Mid-Continent (Group 3):	
150-160 bright stock, solvent refined, 0-10 p.p., 95 v.i.	24
200 vis. neutral oil, solvent refined, 0-10 p.p., 95 v.i.	20.75
Pennsylvania Grade:	
145-155 vis. at 210, bright stock, 8 color, 25 p.t.	27
200 vis. neutral (180 at 100°), 25 p.t.	25

CRUDE-OIL PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.	Mid-Cont.*	Gulf Coast Tex.†	West Tex.‡ N.M.	Wyo. (sour)
14-14.9	$2.42				
15-15.9	2.46				$1.93
16-16.9	2.49				1.97
17-17.9	2.53				2.01
18-18.9	2.57				2.05
19-19.9	2.60				2.09
20-20.9	2.64	$2.50		$2.37	2.13
21-21.9	2.68	2.52		2.39	2.17
22-22.9	2.72	2.54		2.41	2.21
23-23.9	2.76	2.56		2.43	2.25
24-24.9	2.80	2.58	$3.01	2.45	2.28
25-25.9	2.84	2.60	3.03	2.47	2.31
26-26.9	2.88	2.62	3.05	2.49	2.34
27-27.9	2.92	2.64	3.07	2.51	2.37
28-28.9	2.97	2.66	3.09	2.53	2.40
29-29.9	3.02	2.68	3.11	2.55	2.43
30-30.9	3.07	2.70	3.13	2.57	2.46
31-31.9	3.13	2.72		2.59	2.49
32-32.9	3.19	2.74		2.61	2.52
33-33.9	3.25	2.76		2.63	2.55
34-34.9	3.31	2.78		2.65	2.58
35-35.9	3.36	2.80		2.67	2.61
36-36.9	3.40	2.82		2.69	2.64
37-37.9	3.43	2.84		2.71	2.66
38-38.9		2.86		2.73	2.68
39-39.9		2.88		2.75	2.70
40 and up		2.90		2.77	2.72

*Includes Oklahoma, Kansas, North Dakota, West Texas (sweet), North Central Texas, North Louisiana, Arkansas. †Low-cold Texas, North Louisiana, Arkansas. †Low-cold-test Gulf. ‡Sour.

Effective dates: California, November 19, 1956; east of California, June 15, 1953; Pennsylvania Grade, August 16, 1956.

Some crudes in North Central Texas, West Central Texas, and Texas Panhandle have been shifted to the intermediate schedule with $2.83 for 40° and 2 cents per degree drop. Effective dates range from July 15, 1956, to August 10, 1956.

FLAT PRICES

Louisiana:	
Cotton Valley (distillate)	$3.00
Cotton Valley (Holloway crude)	2.95
Texas:	
East Texas	2.90
Chapel Hill	2.83
Conroe	3.13
Van	2.73
Pennsylvania Grade:	
Bradford	4.68
Middle District	4.50
Southwest Pennsylvania	4.21
West Virginia	4.03
Buckeye Grade	4.07
Zanesville Grade	3.15
Illinois Basin	2.90
Canada:	
Leduc-Woodbend (flat prices D-2, D-3)	2.60
Redwater (Alta.) D-3	2.49
Smiley-Viking (Sask.)	2.26
Pembina	2.52

FOREIGN

Venezuela:	
Cumarebo, 48°-49.9°, Tucupido	*3.40
San Joaquin, 41°-41.9°, Puerto La Cruz	*3.04
Oficina, 35°-35.9°, Puerto La Cruz	*2.80
Tia Juana medium, 26.5°-26.9°, Amuay§	†2.30
Quiriquire, 16.5°-16.9°, Caripito	†2.35
Lagunillas heavy, flat, Amuay or Las Piedras§	2.20
★ Bachaquero, 14.5°-14.9°, Las Piedras§	†1.91

*Plus or minus 2 cents per barrel for each degree gravity change. †Plus or minus 2.5 cents per barrel for each half-degree gravity change. ‡Plus or minus 3.5 cents per barrel for each half-degree gravity change. §Also available at La Salina at 3.0 cents per barrel less.

Middle East, Persian Gulf (cargoes, f.o.b. lifting port):	
Arabian, 36.0°-36.9°, Ras Tanura	$1.97
Iranian, 34.0°-34.9°, Bandar Mashur	1.91
Iranian, 34.0°-34.9°, Abadan	1.86
Iraq, 36.0°-36.9°, Fao	1.87
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.72
Qatar, 39.0°-39.9°, Umm Said	2.06
Middle East, E. Mediterranean:	
Arabian, 36.0°-36.9°, Sidon	2.69
Iraq, 36.0°-36.9°, Tripoli, Banias	2.69
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°-38°	2.60

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(Latest reported spot fixtures)

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★ P.G.-U.K., dirty (USMC+350%)	49.05

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FOR SALE: Marine Seismic Equipment. 1 Power Reel, 12 Gimbaled Geophones with necessary cable sections. Kerr-McGee Oil Inds. Inc. Kerr-McGee Building, Oklahoma City.

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Civil, Mechanical, or Chemical Engineering Degree required, plus minimum 5 years responsible supervision of union crafts in construction of above plants. Some engineering design also preferred.

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FOREIGN EMPLOYMENT. List oil companies, drilling contractors, seismograph contractors, showing where apply foreign jobs. $5.00 cash. OIML Co., Box 2603, Tulsa, Okla.

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SUBSURFACE GEOLOGIST—Nortex Oil and Gas Corp. has position open for Subsurface Geologist. Minimum of two years of regional mapping experience in West Texas. Position involves regional subsurface studies. Dallas location. Send complete resume of education and experience, including salary requirements. All replies confidential. Chief Geologist, Nortex Oil and Gas Corp., 1900 Life of America Bldg., Dallas, Texas.

CHIEF CHEMIST with at least six years refinery experience. Must be aggressive and have some asphalt experience, for an 18,000 BPD Independent Texas Refinery. Also Chemist with at least three years experience to handle gasoline research as well as other light oil products. Apply Box J-776, The Oil and Gas Journal, Tulsa, Oklahoma.

GOOD OPPORTUNITY: Age 29-39 Experienced Drilling Engineer needed for work with large aggressive drilling company specializing in offshore work. Need ability to make contacts and negotiate contracts. Salary commensurate with experience. Box J-844, The Oil and Gas Journal, Tulsa, Oklahoma.

DESIRE AN OPPORTUNITY in smaller organization which promotes individual development and advancement? Nationwide insurance underwriting group has engineering staff openings for a few progressive young technical men. Diversified and interesting work in contact with major concerns in the Oil, Gas and Petrochemical industries. Some travel involved, with car provided. Prefer men with one to three years experience. Salary commensurate with qualifications and experience. Located Chicago, Dallas, Los Angeles, New York, Tulsa. All replies held confidential. Box J-849, The Oil and Gas Journal, Tulsa, Oklahoma.

ENGINEER, mechanical for oilfield machinery design with top national manufacturer. Prefer experience—not necessary. Enjoy friendliness of small community but security with large progressive company. Unusual opportunity for man with both design and administrative ability. Write giving details to: Box 761, Gainesville, Texas.

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ENGINEERING OPPORTUNITY

A graduate mechanical engineer with production or well completion experience needed. Job will require design work and some travel. Headquarters in Houston—reply

BOX J-850,
THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

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PETROLEUM ENGINEER under 32 with minimum of three years' experience in drilling and completion to work in Corpus Christi, Texas, area for large independent oil company. Gulf coast water flood experience desirable. Must be capable of assuming responsibility and be willing to locate in Rockport, Texas. Write details of experience, education, and personal history to P. O. Box 3053, Dallas, Texas, and enclose small photo.

SITUATIONS WANTED

GEOPHYSICIST—15 years interpretation & supervisory experience, desires change. Reply Box J-845, The Oil and Gas Journal, Tulsa, Oklahoma.

GAS ENGINEER: Age 33, chemical engineer degree, seven years experience in gas plants, measurement, gas wells. Desires responsible position. Box J-848, The Oil and Gas Journal, Tulsa, Oklahoma.

GRADUATE PETROLEUM ENGINEER: 7 years experience, Drilling, Production, Workover. Desire responsible position with independent or small aggressive oil co. Box J-846, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOPHYSICIST: 11 years field experience, seismic interpretation and operations. Graduate geologist; seeks association with independent. Age 40. Box J-852, The Oil and Gas Journal, Tulsa, Okla.

PETROLEUM ENGINEER, M.S., 8 years varied production and drilling experience desires responsible position in Rocky Mountain or Mid-Continent Area. Box J-851, The Oil and Gas Journal, Tulsa, Oklahoma.

SALESMAN, Asphalt Products: Presently employed. Twelve years sales experience, allied fields. Age 38. Have setup distributors. Sterling Harris, 10001 Ridgeview, Oklahoma City.

PRODUCTION SUPT.: Age 41. 22 yrs. experience in drilling, production, and water flooding. Penna. & Okla. fields. Box J-841, The Oil and Gas Journal, Tulsa, Oklahoma.

COMPLETION and Production Man, age 40, can give required reference. Box J-840, The Oil and Gas Journal, Tulsa, Oklahoma.

ADMINISTRATIVE GEOLOGIST: 37, 15 yrs. exp. 10 years Adm., Exec., Personnel Mgr. Thoroughly acquainted all phases Geol. degree, grad. studies, legal training. Wide exp. Rocky Mts., Texas, Canada, Mid-Continent, Ill.-Ind., N. Mex.; presently attending law school. Available 90 days. Seeks permanent position. Box 328, Valparaiso, Indiana.

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SOBER, FAMILY MAN, with 25 years oil field experience desires position with responsible company as Tool Pusher, Drilling Superintendent, Work-over or Completion man. Will relocate. Box J-829, The Oil and Gas Journal, Tulsa, Oklahoma.

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WANTED: Producing oil & gas leases in Kansas & Oklahoma. From 50 to 500 barrels daily production. Will deal direct with owner or thru brokers. Box J-847, The Oil and Gas Journal, Tulsa, Oklahoma.

WANT TO BUY—Oil Properties, settled or semi-settled production. 100 to 5,000 barrels daily in Oklahoma and Kansas. Contact Morris Sitrin, 1215 First National Building, Tulsa, Oklahoma.

WANTED Oil production 100 bbls. and up, any size, prefer Okla., N. M., Tex., Colo. or Kan. B. Thurston, 1427 Princeton NE, Albuquerque, N. M.

OIL PRODUCING properties wanted. Full information in first letter. Box J-824, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED

WANTED: Production West Central Texas. Send complete details. Texas Canyon Oil Company, 1209 Texas National Bank Building, Houston, Texas. Phone: CApital 7-5184.

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OIL COMPANY offers attractive drilling deal or farmout. Good opportunity for tax money. Box J-811, The Oil and Gas Journal, Tulsa, Oklahoma.

North Chaves County, N. M.

One field recommended already important discovery. Other major area to drill. Lease or Royalty interests at low cost in either field offer great potential value. Data on request.

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Brown Fintube Forms Subsidiary Company

John W. Brown, Jr., president of Brown Fintube Co., Elyria, Ohio, has announced the formation of a subsidiary to be known as The Brown Thermal Development Co.

The new company will develop, design, manufacture and sell heat-transfer equipment for waste-heat recovery, recuperation, and air and gas heating by direct fire. The fired heater division of Brown Fintube Co. will be incorporated within The Brown Thermal Development Co.

The officers of the new company are: John W. Brown, Jr., president; Arvid C. K. Nihlen, vice president; Carroll M. Tate, vice president of sales; Howard A. Niederst, treasurer; Robert E. Preston, chief engineer; and Thomas P. Kroehle, chief sales engineer.

Harnischfeger Names P&H Diesel Distributor

Appointment of Rental Service Co., Philadelphia, as a new P&H diesel distributor was made recently by the diesel engine division, Harnischfeger Corp., Crystal Lake, Ill. Headed by Jack Davies as president and sales manager, the new P&H distributor is a division of Service Supply Corp. of Philadelphia.

Rental Service Co. will sell P&H industrial diesel-power units and automotive diesel engines. P&H engines are available in 2, 3, 4, and 6-cylinder models ranging up to 280 hp. The new distributor will also sell the P&H diesel-powered electrical generating sets which are sold in models of 20 to 125-kw. capacities.

The sales territory involved in the arrangement includes the State of Delaware, eastern Pennsylvania, and southern New Jersey.

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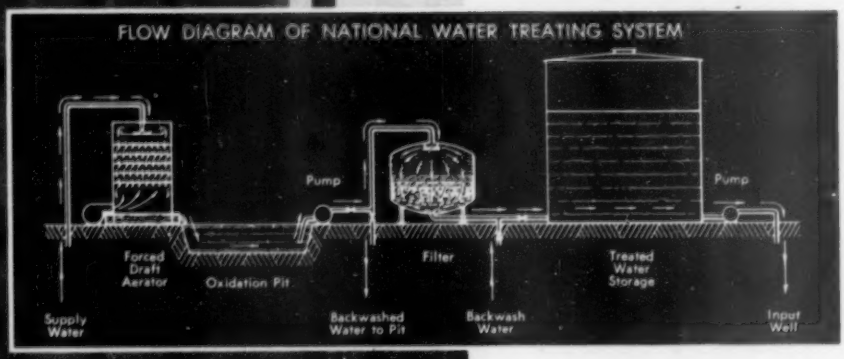
LEGAL

U. S. DEPARTMENT OF THE INTERIOR BUREAU OF LAND MANAGEMENT, Land Office, Cheyenne, Wyoming. Notice is hereby given that approximately 3153.02 acres of land in twenty-one parcels within the known geologic structures of the East Ferris Dome, West Ferris Dome, and East Mahoney Dome fields, Wyoming, will be offered for oil and gas leasing through competitive bidding to the qualified bidder of the highest cash amount per acre through sealed bids on or before February 5, 1957, when bids will be opened. Details of the lease offering, and how and where to submit bids, may be obtained from the Land Office, Cheyenne, Wyoming. Perry T. Williams, Manager.

AERATION!

National Aerator for treating supply water or disposal water in open water system.



Two National Aerators in series with water supply well located north of Tulsa, Oklahoma.

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Salt Water Treating

The National forced draft Aerator is fabricated of redwood with reinforced fiber glass distributor and splash trays, to facilitate ease of and reduce frequency of cleaning. Distribution of water from tray to tray assures liberation of water-bound gases which are expelled to the atmosphere by controlling the volume of air introduced at bottom of the Aerator.

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Youngstown

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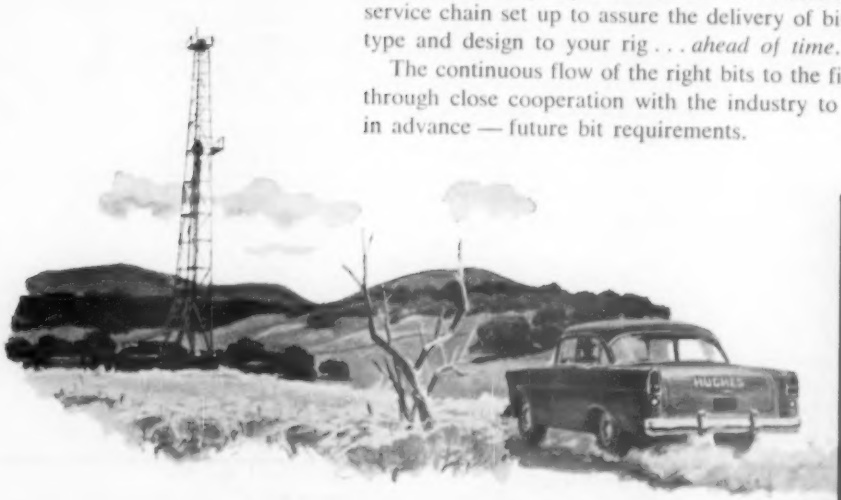
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